OCTOBER 1961

Heating Piping & Air Conditioning

. . . for Consulting Engineers
Mechanical (HPAC) Contractors
Engineers with Plants & Buildings

How to Select Centrifugal Pumps . . . page 115

Air Conditioning Modernizes A 10-Story Office Building . . . page 122

U-Bends Cure Pipe Leakage Caused by Misalignment . . . page 127

How About HTHW For Process Heating? . . . page 128

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Direct Reading Tables Give Sheet Metal Duct Weights . . . page 165

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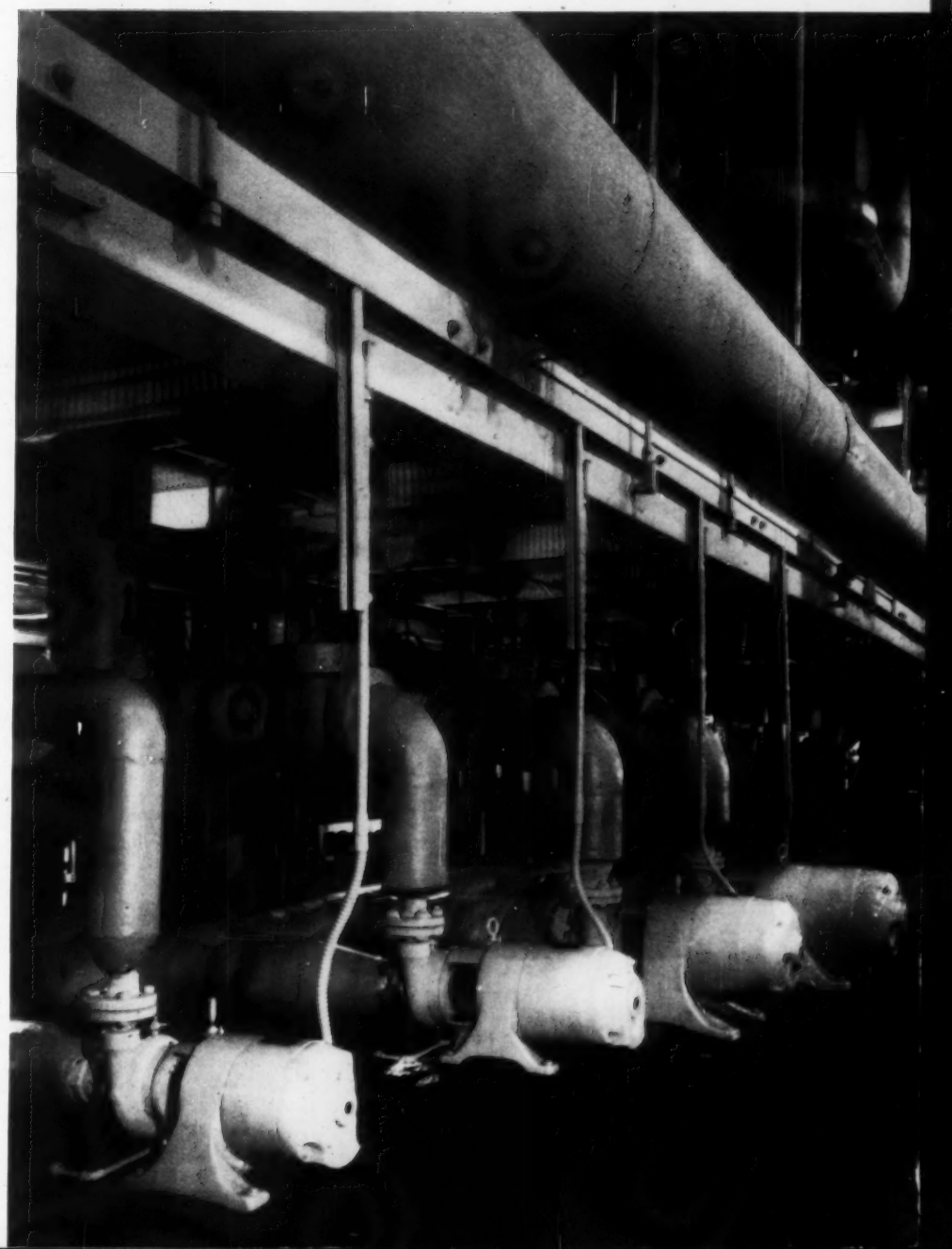

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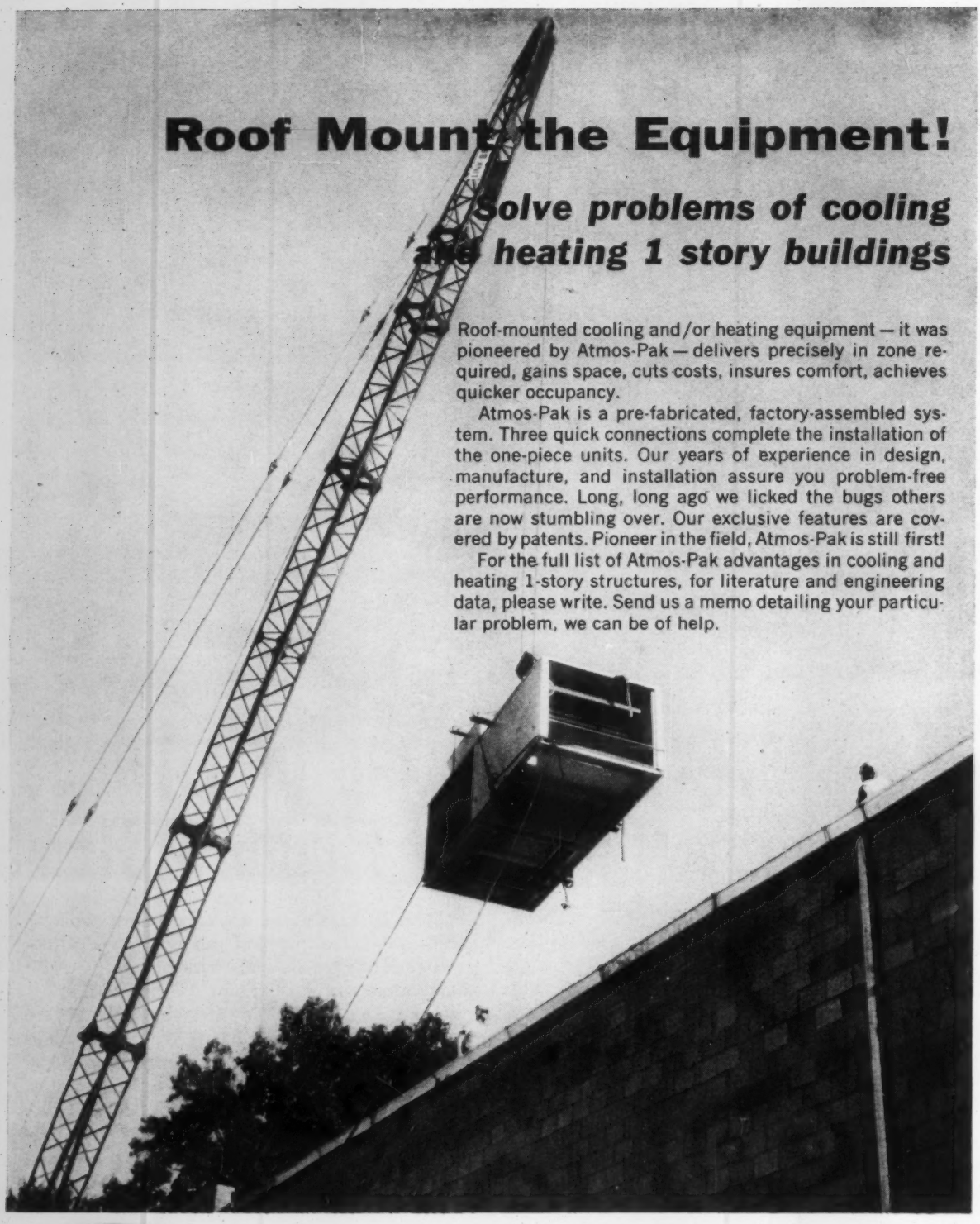

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VOL. 33, NO. 10 OCTOBER 1961

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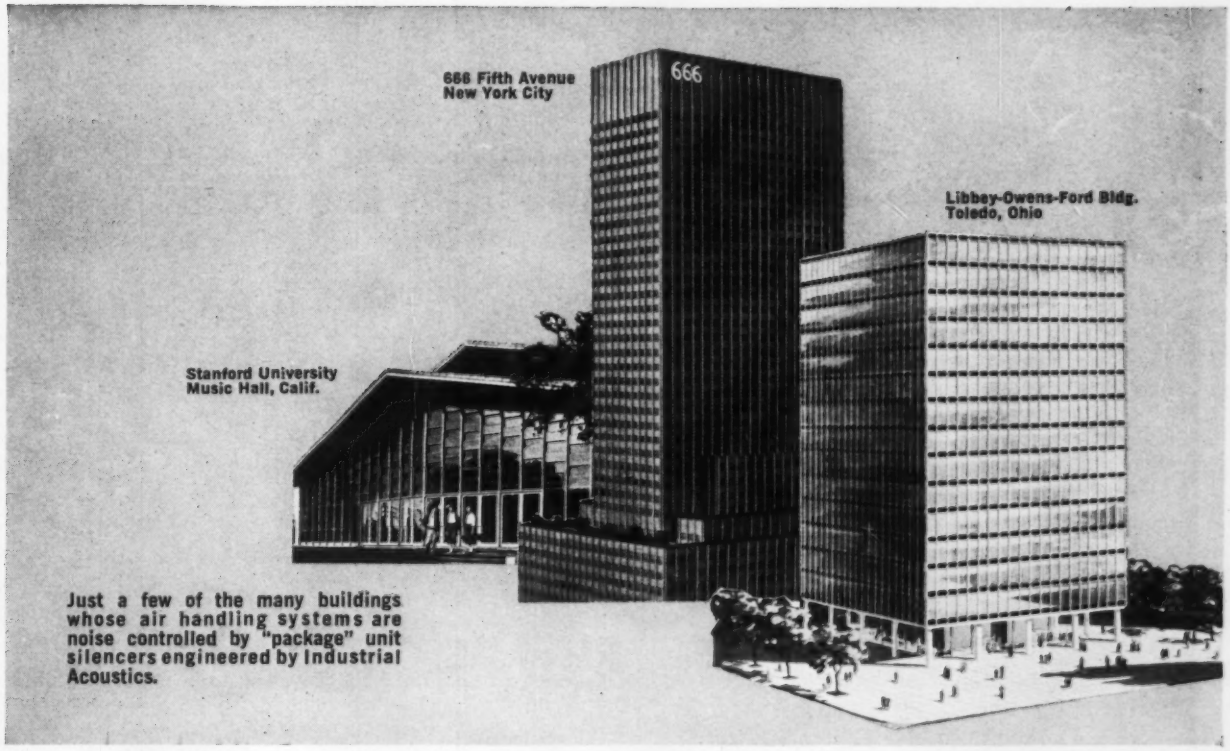
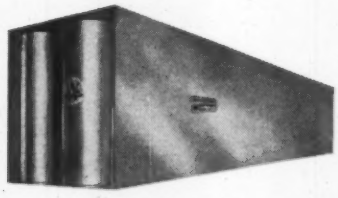


Just a few of the many buildings whose air handling systems are noise controlled by "package" unit silencers engineered by Industrial Acoustics.



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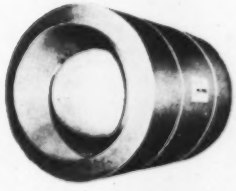

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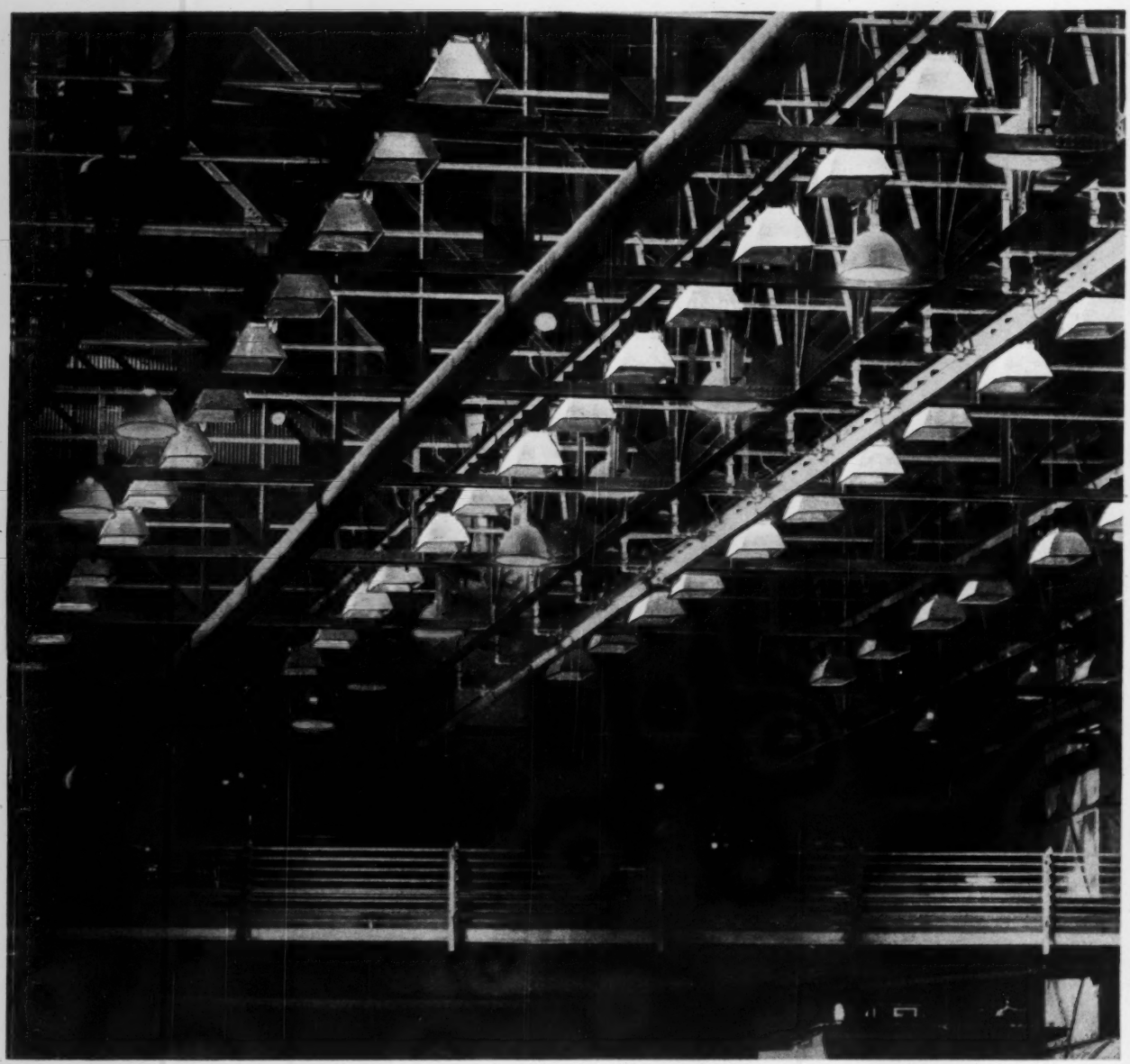
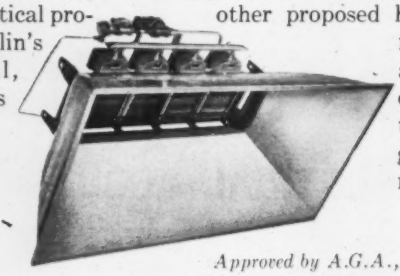


300 (48,000 *BTU/H*) *Perfection Schwank Gas Infra-Red Heaters* Mounted at a height of 36 ft., heat the area of 100 ft. wide by 500 ft.*

J & L Steel Saves 46% in BTU's with

Minimum 55° machinery temperature is necessary to guarantee peak operating efficiency of critical production equipment at Jones & Laughlin's No. 1 Continuous Weld Pipe Mill, Aliquippa, Pa. Replacing their previous heating equipment, 300 Perfection Schwank *Gas* Infra-Red Heaters (600 in the entire plant) meet this tough requirement with a BTU capacity 46% less than any other proposed heating system. Total maintenance requirements consist of air blowing the gas-fired units once each heating season. After three full seasons of dependable gas heat and employee comfort, not one of the 2,400 ceramic



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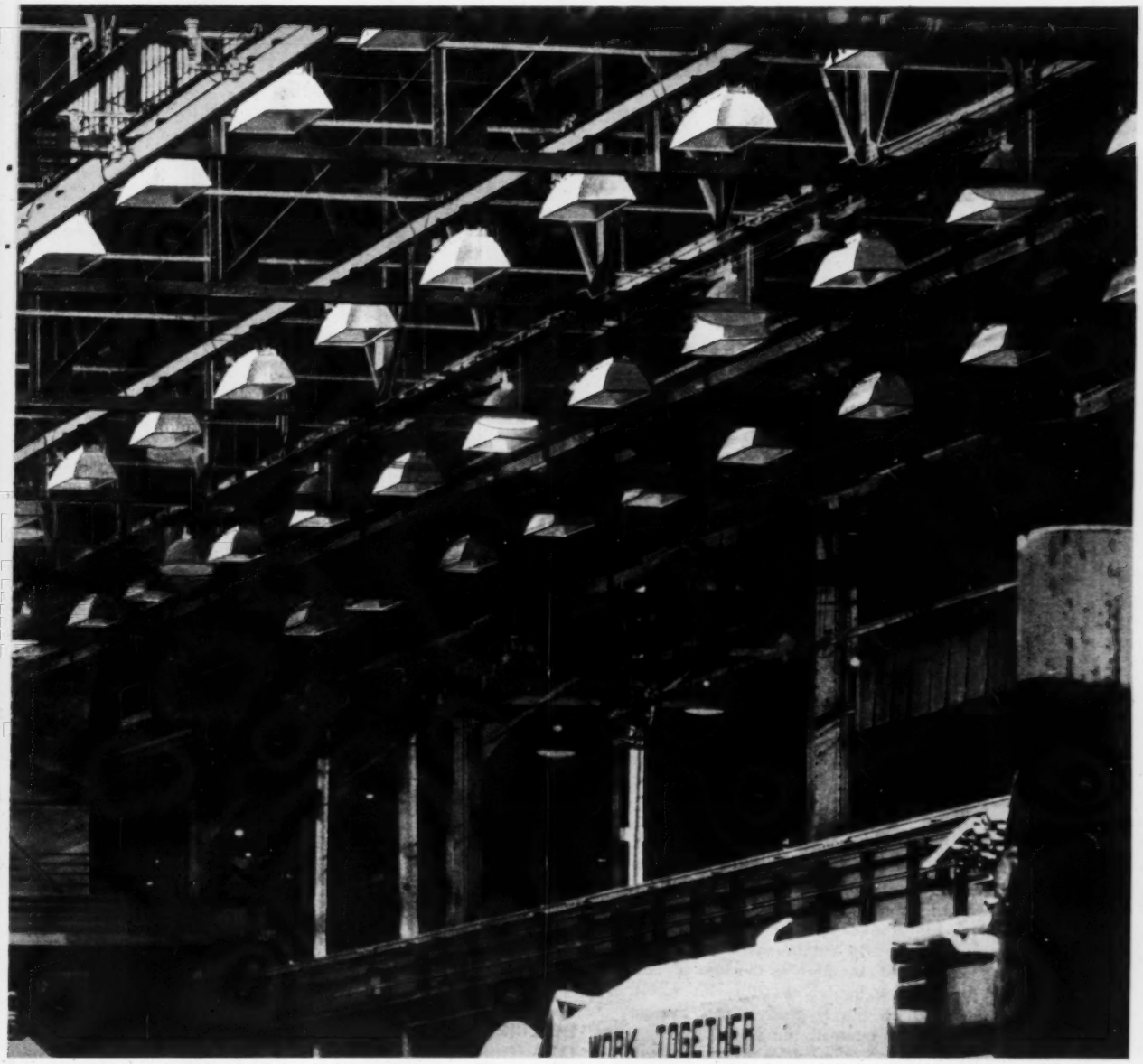

long without partitions or walls to adjoining plant areas. These gas-fired heaters are part of the 600 installed at J & L's Aliquippa Works.

Perfection Schwank Gas Infra-Red Heaters

burners (4 per heater) has needed replacement.

Perfection Schwank *Gas* Infra-Red Heaters give J & L all the advantages of modern *gas* heat . . . high efficiency, precise control, speed, cleanliness, economy and dependability of supply. Gas can be the answer to your unusual or everyday heating problems.

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°Under Schwank U.S. Patents 2,775,294 and 2,870,830 and pending applications.

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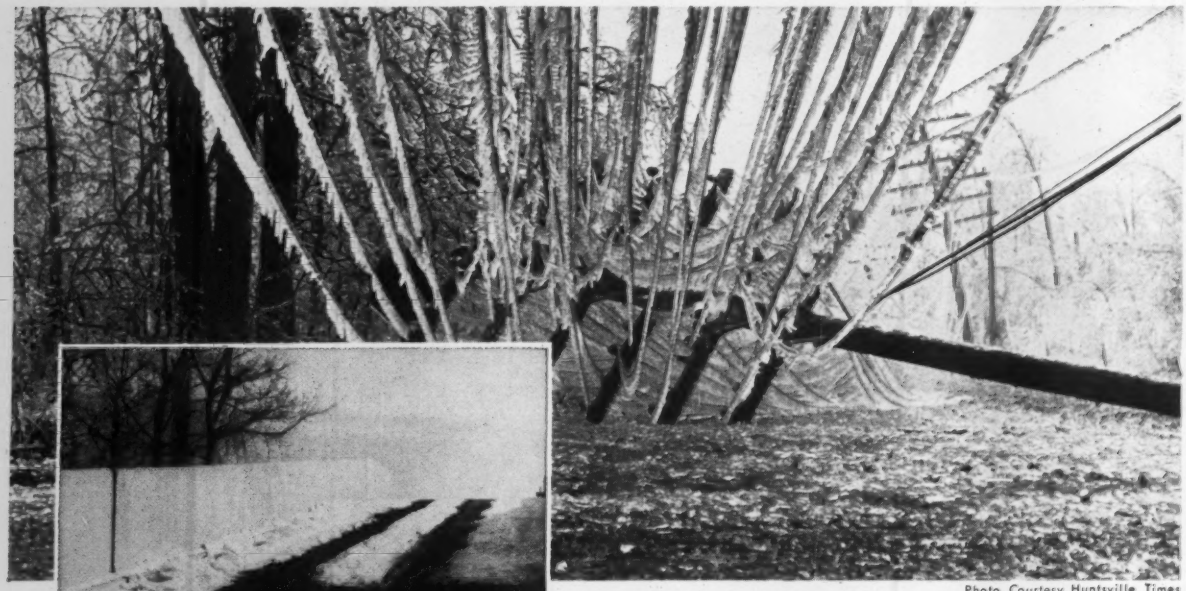

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RAILROAD SWITCHES

PHOTO ABOVE: Shows ramp leading to second floor parking lot of a publishing firm. Equipped with electric heating elements to melt snow and ice, the system formerly was manually controlled. During a heavy snow fall, the watchman failed to turn on the system. At 8:00 next morning, more than 100 employees were unable to get into the parking lot, resulting in the loss of 100 man-hours of time (approximately $500). This would have more than paid for the Hygrodynamics System which now automatically controls the installation.

Frequently, manually-controlled de-icing systems are turned on only after ice and snow have accumulated. The unique Hygrodynamics System promotes additional economy in that only 1/10 the heating power is required to prevent ice formation, than to remove it.

PEDESTRIAN BRIDGES: Last year, the fuel to operate heating elements that keep three East Coast pedestrian bridges free of snow and ice, cost $1100 during the month of February. Heaters are controlled by a thermostat which senses only changes in temperature. During the period, the temperature was almost constantly below 32°F, however, there were only three days during the month when ice or snow accumulated.

By replacing the thermostat control with an automatic Hygrodynamics Snow/Ice Control System (which actuates the heaters only when snow or ice conditions exist), the corresponding power cost would be approximately $110. The $990 one-month saving in this case is considerably greater than the cost of the new Controller.

OTHER APPLICATIONS: Hygrodynamics Snow/Ice Control Systems are also in use in the DEW LINE (Distant Early Warning Radar Net) and the WHITE ALICE Project (Alaskan Integrated Communications Exchange) where they keep antennae free from ice.

DESCRIPTION: Sleet/Ice Control Systems consist of: (1) A Detector Unit installed on the facility being monitored; and (2) A Controller installed indoors at distances up to 2000 feet from the detecting unit. The Detector incorporates both an adjustable thermostat, and a plug-in precipitation element so that auxiliary equipment is actuated only when icing conditions (low temperature and precipitation in any form) exist.

The system can be used to actuate automatically: (1) heating pipes embedded in loading ramps, sidewalks, bridge approaches; (2) radiant heating elements for drive-in windows and toll gates; (3) defrosters for radio, TV and radar antennae; (4) icing condition signals for highways, etc.

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LETTER FROM THE EDITOR

October 1961

Dear Reader:

Do you sometimes wonder if the pump you have selected for a piping system is the correct one after it has been installed and before operation of the system has begun? We all know that misapplications of pumps occur and that systems fail because of improper selection of the pump, and of course we all also know it shouldn't happen. Needless to say, correct pump selection is critical for the proper operation of any piping system. The important factors that need to be considered are outlined on page 115 by Harold Woodhouse. This guide to selecting centrifugal pumps is worth reading and saving for your future reference.

There are still many existing buildings that need air conditioning, and this work is proceeding consistently with many different kinds of problems being met on each job. Planning and careful consideration of the practical methods applicable for each job generally pay off in the final result. So it was with the 10-story Fireman's Insurance Building in Newark. Richard Graef explains what was done on this job on page 122. He tells how the job was completed in minimum time without undue interruption of the tenant's routines. He has also included cost information for the three systems that were finally considered before selection of the one.

D. G. Poppe, plant engineer at the Uranium Reduction Company plant in Moab, Utah prepared the article on page 127 for this issue. In this he explains how leaks have been eliminated in the process piping systems in his plant. He found that a double offset expansion U-bend fabricated for each pump solved the problem of misalignment of the pumps and piping components in the system. What do you think of this idea?

High temperature hot water heating systems may also be used in many different kinds of process applications as well as in space heating, according to Anton Krapek. Of course the selection of the heat transfer coils is critical, and Mr. Krapek explains on page 128 how to do this. He also tells what must be considered in designing these systems.

Comfort air conditioning for cargo ships presents many interesting problems that are explained by John Markert on page 135. He tells how induction systems have been used on the new Lykes Brothers cargo vessels along with prefabricated sheet metal ducts and fittings for the first time. With the increasing need for careful use of space for air conditioning ducts and equipment for all types of buildings, this article gives some practical answers that may be applied on other jobs too.

LETTER FROM THE EDITOR (Continued) --

Controlling dust in industry is often difficult and costly when the necessary large volumes of make-up air are considered along with the potential problems of air pollution inside the plant and out. J. L. Burgess has one solution to this problem which is outlined in his article on page 138. He explains how a tool-mounted, low volume, high velocity system designed to collect harmful dusts at the source has proven to be effective.

With the procedure outlined on page 144 you will be able to construct your own high altitude psychrometric charts for any desired condition. As we all know, altitude has a marked effect upon the performance of heating and air conditioning systems. Here's an article prepared by Roger Haines based upon his experiences and the need he has found for such charts that will be of help to you in this.

A practical piping tip on a method for "unfreezing" process lines is given by C. A. Lee on page 147. Mr. Lee calls on his 25 years of experience with piping design, installation, operation, and maintenance for this tip.

What's the best way to deliver conditioned air to a number of zones? This question and many others are answered by F. F. Stevenson in his article on page 148. Eight different systems of air treatment and air distribution are discussed in this article. Mr. Stevenson comments on the relative costs of each along with other valuable information about these systems from his many years of experience.

Complete records of heating and air conditioning costs for one year at Southern Methodist University in Dallas is the basis for the article on page 156. This is probably the most complete analysis which has ever been made of any University plant, according to David C. Pfeiffer, author and Director of the Physical Plant at SMU. The system is served by two 1000 ton steam-turbine-driven centrifugal compressors and three 500 hp motor-driven centrifugal compressors for the air conditioning systems.

Tables for calculating weights of sheet metal ducts are presented in the Data Sheet on page 165. Willie Hammer is the author.

Do you have some suggestions on how radiant heating systems should be protected from freeze-up? Two answers to this question are given on pages 108 and 110.

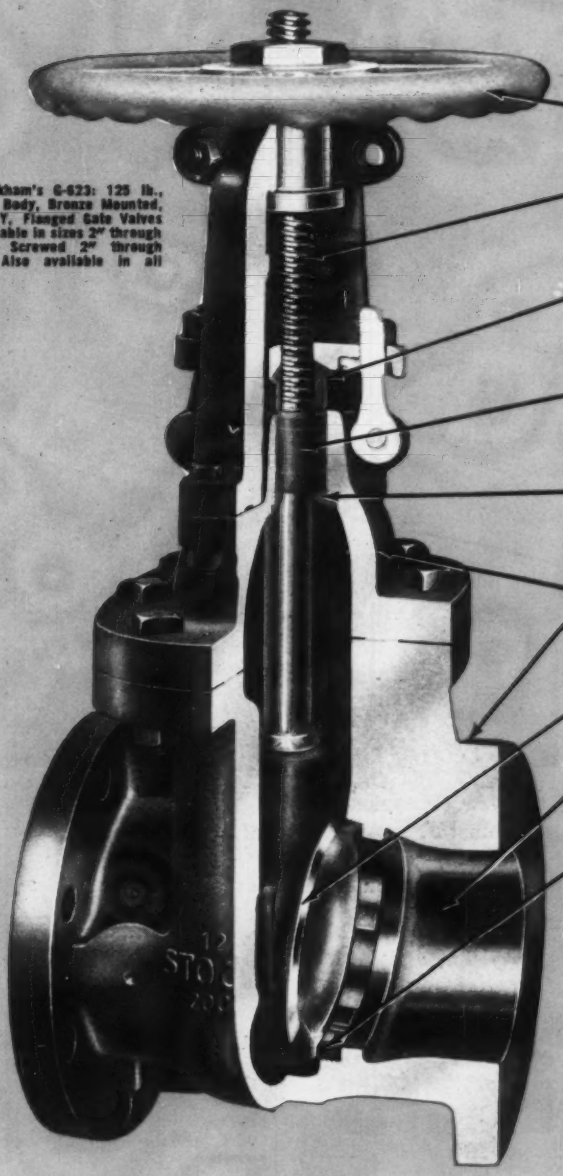
Many interesting news items are in the You'll Want to Know section (pages 47 to 50) which you will want to see, I'm sure. Of course many other items of interest will also be found in the issue as you go through it. Don't forget -- your comments are always welcome you know.

Bob Roose

Editor

WORKS BEST... WORKS LONGEST!

FOR 9 GOOD REASONS:



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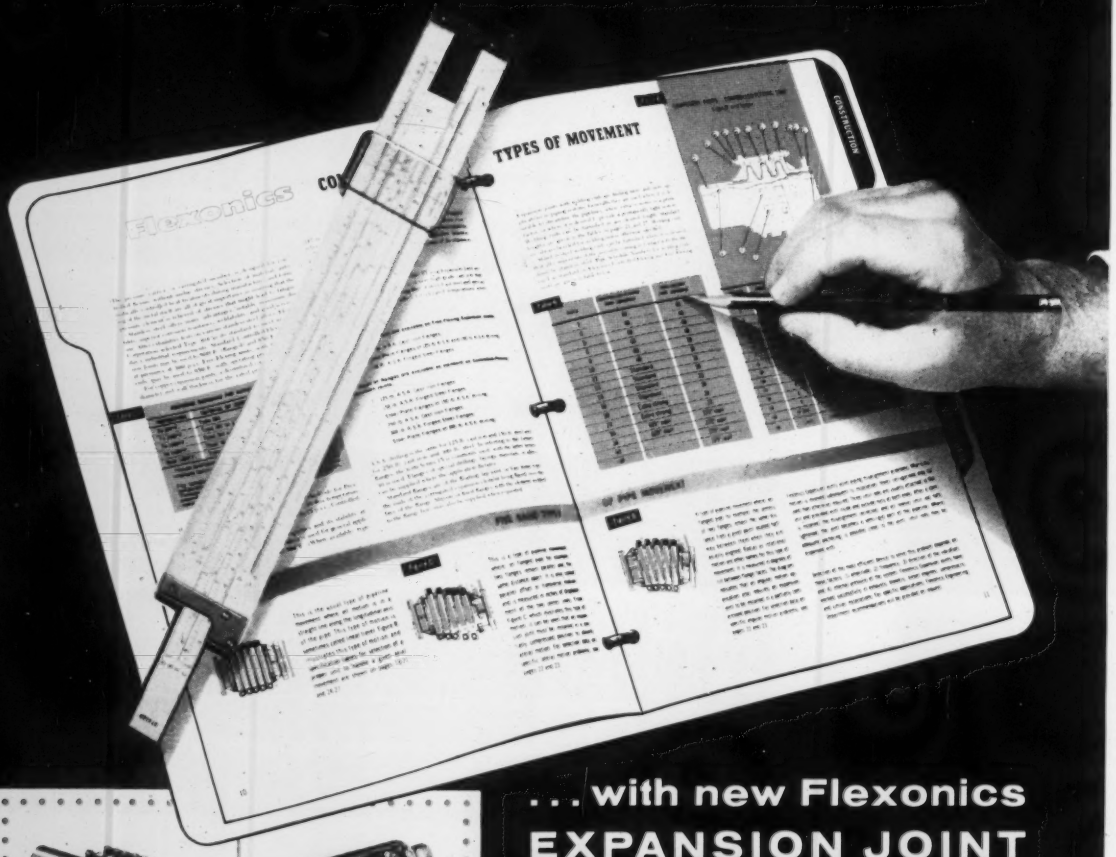

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200-pound Bronze Globe Valve—Fig. 102. Union bonnet. Renewable nickel-bronze seat and disc. Sizes, ⅛" through 3". Angle and flanged end valves available.

150-pound Bronze Gate Valve—Fig. 2714. Union bonnet. Inside screw rising stem. Sizes, ⅛" through 3" with solid wedge; ½" through 3" with split wedge.

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150-pound Bronze Globe Valves—Fig. 150. Union bonnet. Renewable composition disc. Sizes, ⅛" through 3". Angle and flanged end valves can be supplied.

150-pound Bronze Gate Valve—Fig. 1414G. Bolted, flanged yoke-bonnet. Outside screw rising stem. Solid wedge. Sizes, 2" through 12". Screwed end valves can be furnished.

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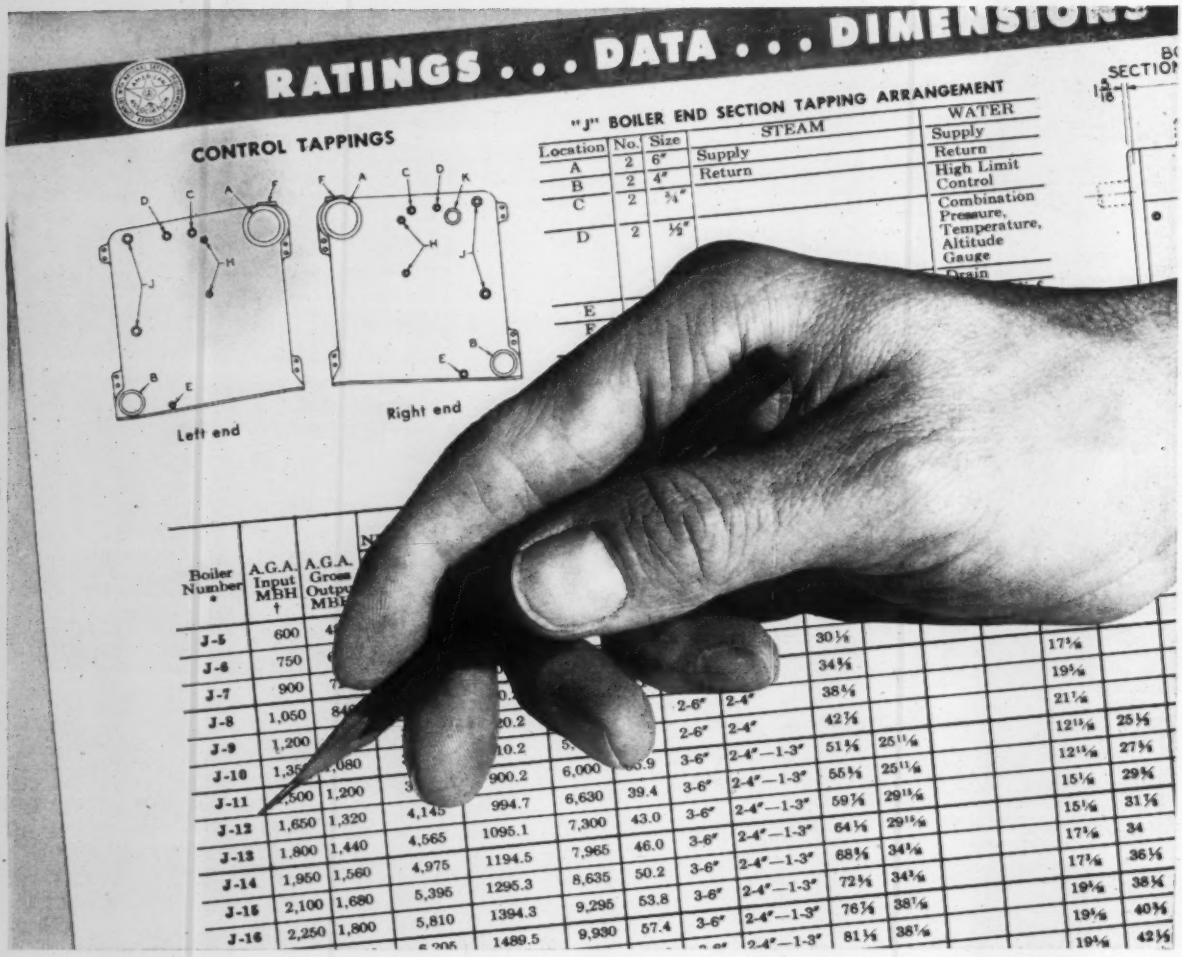
POWELL DEPENDABLE **VALVES**

THE WM. POWELL COMPANY CINCINNATI 22, OHIO


RATINGS . . . DATA . . . DIMENSIONS
CONTROL TAPPINGS
Left end
Right end
"J" BOILER END SECTION TAPPING ARRANGEMENT
Location | No. | Size | STEAM | WATER
A | 2 | 6" | Supply | Supply
B | 2 | 4" | Return | Return
C | 2 | ¾" | | High Limit Control
D | 2 | ½" | | Combination Pressure, Temperature, Altitude Gauge
E | | | | Drain
F
SECTION

Boiler Number *	A.G.A. Input MBH †	A.G.A. Gross Output MBH														
J-5	600	4									30½				17⅞	
J-6	750	6									34⅝				19⅝	
J-7	900	7									38⅝				21⅝	
J-8	1,050	84			20.2			2-6"	2-4"		42⅞				12½	25½
J-9	1,200				10.2	5		2-6"	2-4"						12½	27½
J-10	1,35	1,080	3		900.2	6,000	39.9	3-6"	2-4"—1-3"	51½	25½				15⅛	29⅝
J-11	1,500	1,200	3													
J-12	1,650	1,320	4,145	994.7	6,630	39.4	3-6"	2-4"—1-3"	55½	25½					15⅛	31⅞
J-13	1,800	1,440	4,565	1095.1	7,300	43.0	3-6"	2-4"—1-3"	59⅞	29½					17⅛	34
J-14	1,950	1,560	4,975	1194.5	7,965	46.0	3-6"	2-4"—1-3"	64½	29½					17⅛	36½
J-15	2,100	1,680	5,395	1295.3	8,635	50.2	3-6"	2-4"—1-3"	68⅝	34½					19⅛	38⅝
J-16	2,250	1,800	5,810	1394.3	9,295	53.8	3-6"	2-4"—1-3"	72½	34½					19⅛	40½
			6,205	1489.5	9,930	57.4		2-4"—1-3"	76¾	38½					19⅛	42½
									81½	38½						

33 GAS BOILER SIZES IN 500 sq. ft. INCREMENTS PREVENT OVERSIZING WASTE

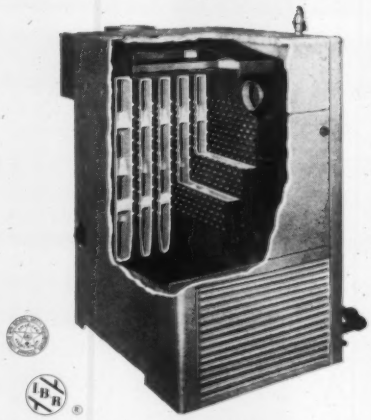
Oversizing a boiler because of inability to closely match boiler capacity to heating load increases operating cost and required boiler room space.

In Weil-McLain Type "J" Gas Boilers, the flexibility of cast iron sectional construction has permitted the design of a complete line of boilers *with sizes increasing in steps of only 500 gross sq. ft. each!*

Close sizing is only one of the ways in which a "J" Boiler saves money. For example, a high chimney, or forced or induced draft are not necessary for proper operation...all "J" boilers can operate with only a vent. And rating for rating, a "J" boiler takes less boiler room space than a typical scotch marine boiler.

Other *"extra values"*

A.G.A. approved efficiency...available with A.G.A. approved dual fuel manifold...Electronic controls and pre-wired control panels are engineered as part of unit...no refractories, motors, fans, tubes or water treatment.



TYPE "J" GAS BOILER

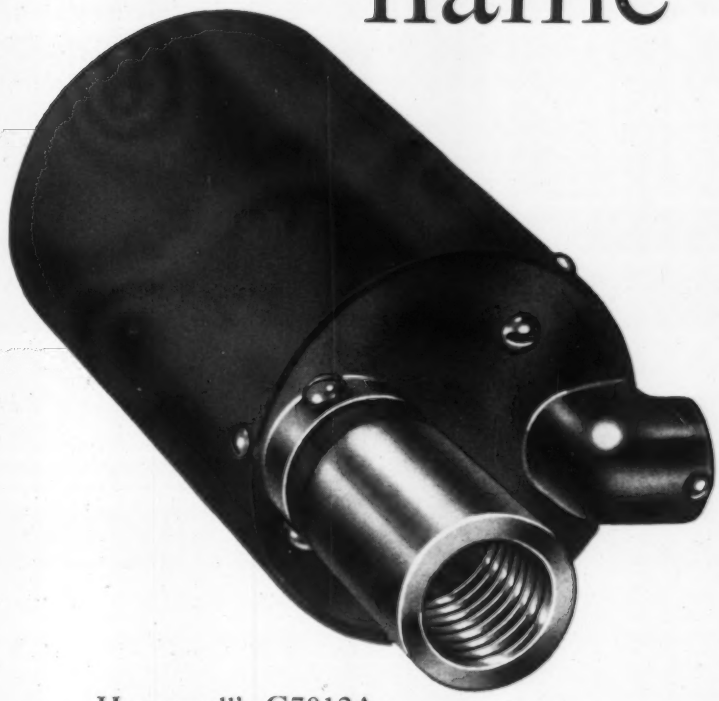
Net I=B=R Capacities: 360,100—3,354,000 BTU/hr.

Send for Bulletin C-297

WEIL-McLAIN CAST IRON BOILERS

WEIL-McLAIN COMPANY • Dept. AA-101 • MICHIGAN CITY, INDIANA

Senses only the flame



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R478
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V4034
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Gas Valve

L404
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M931
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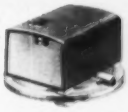
V4021
Oil Valve



C645
Pressure Switch

V4004
Diaphragm
Gas Valve

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SINCE 1885

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True lamp color—all lamp types / Reduced maintenance
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No ceiling or wall smudging—lowest maintenance
Quietest air diffusion—no drafts
Lowest total cost—ask for our comparison data

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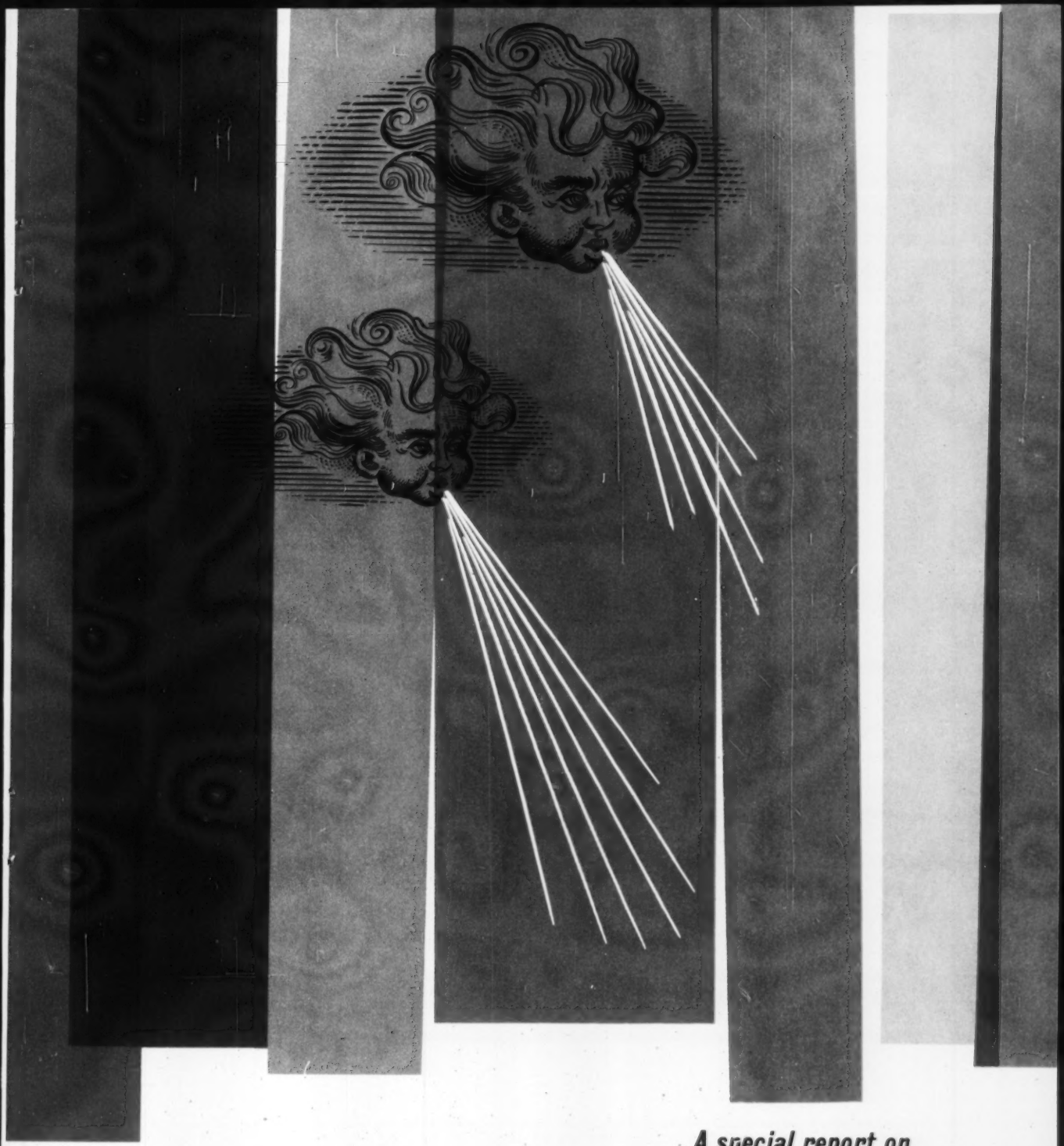


A special report on

ARMSTRONG VENTILATING CEILINGS

A remarkable new plenum-engineered ventilating system

ARMSTRONG VENTILATING CEILINGS

their advantages

1. A completely proven ceiling ventilating system

This new air-diffusion system is essentially an air-inlet system, employing a ceiling with thousands of perforations through which conditioned air is pushed from the plenum. Armstrong Ventilating Ceilings have been thoroughly lab- and job-tested. The engineering bases for this new kind of ventilating system have been fully developed for virtually all types of structures. Ventilating Ceilings have been used by a number of architects in a variety of different jobs. One of them—the Battle Creek Country Club—is shown at right. Some other recent jobs are listed on the last page of this report.

2. Shaves construction costs, cuts ductwork, eliminates diffusers

An Armstrong Ventilating Ceiling performs three essential functions: air diffusion, sound absorption, decoration. And when you use Armstrong Fire Guard in a Ventilating Ceiling, you can add a fourth function: time-design-rated fire protection. Since the plenum chamber acts as the room duct in an Armstrong Ventilating Ceiling, and since one duct stub is sufficient for most plenum chambers, much of the supply ductwork is eliminated. So are the diffusers, because the ceiling itself serves as the diffuser. In both new construction and remodeling, these two things alone offer appreciable cost savings. An Armstrong Ventilating Ceiling often permits the use of a shallower plenum than the conventional air-inlet system. This, too, saves money, by enabling you to have the required number of floors with less total building height.

3. Provides a handsome acoustical ceiling

Because an Armstrong Ventilating Ceiling eliminates the need for diffusers—or other noticeable air openings—it provides new opportunities for creative effects. In the Battle Creek Country Club, shown at right, the architects have created distinctive character with a giant-coffered ceiling, incorporating Ventilating Tile. In each tile, the tiny ventilating perforations account for two per cent of the surface. And they're virtually invisible, because they're part of the over-all pattern. Ventilating Ceilings are available in a number of different designs, in both tile and lay-in units, so you can select the one that best meets your aesthetic needs.

Renderings by Ara Derderian

ARMSTRONG VENTILATING CEILINGS

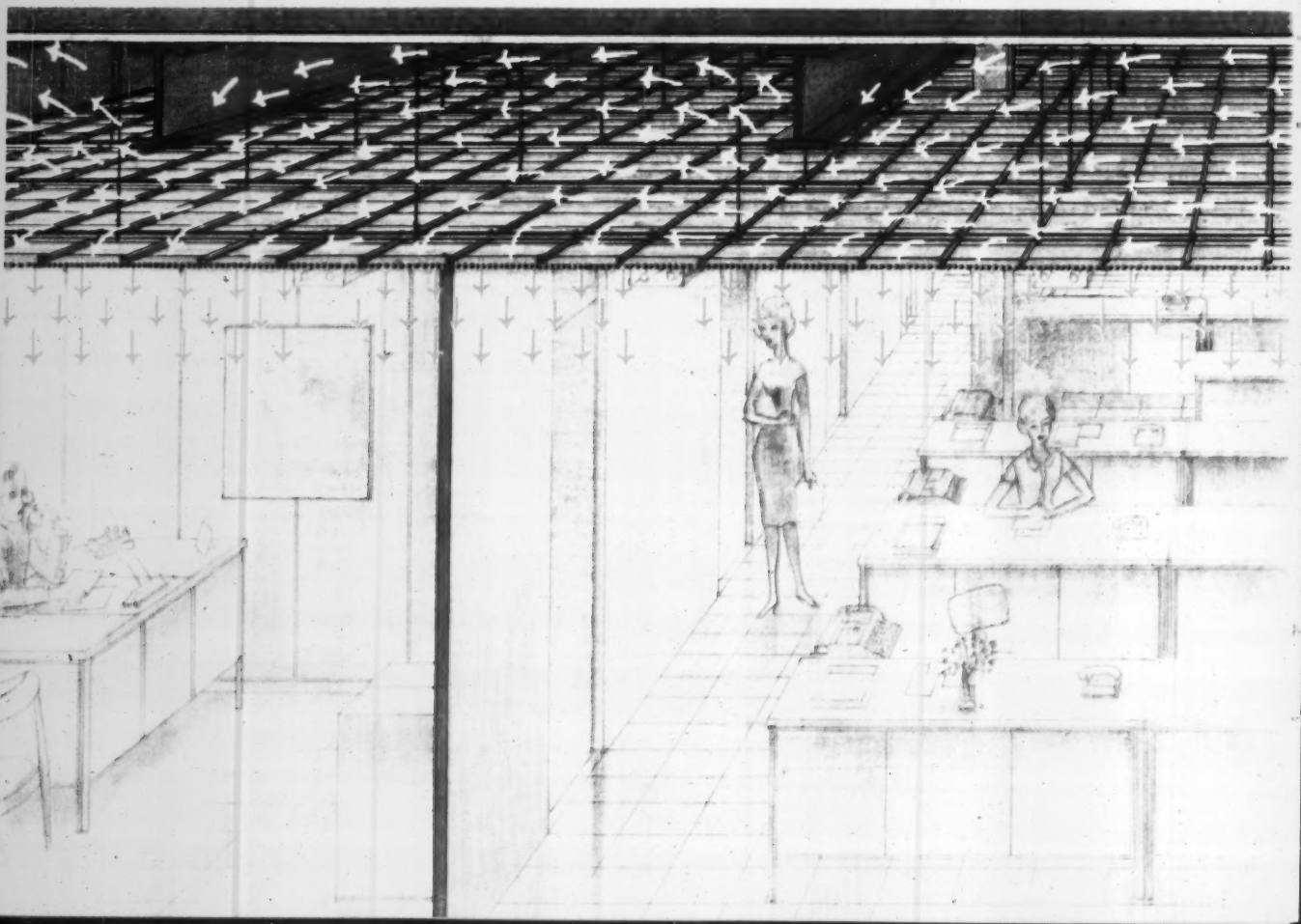
their functions

1. They air-condition—providing uniform air diffusion

Since the ceiling itself serves as a diffuser, an even flow of air is provided into and throughout the room. An Armstrong Ventilating Ceiling enables you to eliminate drafts and stagnant areas. Even in low-ceiling areas, draft problems can be eliminated. The picture below of a section of an office building shows how conditioned air is forced, under pressure, from the central unit through ducts to the duct stub supplying each plenum chamber. The result—comfort for all occupants.

2. They're self-cleaning—the down pressure provides a perpetual barrier against dirt and dust

Besides cooling or heating, the air forced through the perforations in an Armstrong Ventilating Ceiling repels dust and dirt, since there is a continuous flow of air flowing downward from the ceiling. The ceiling is, in effect, self-cleaning.

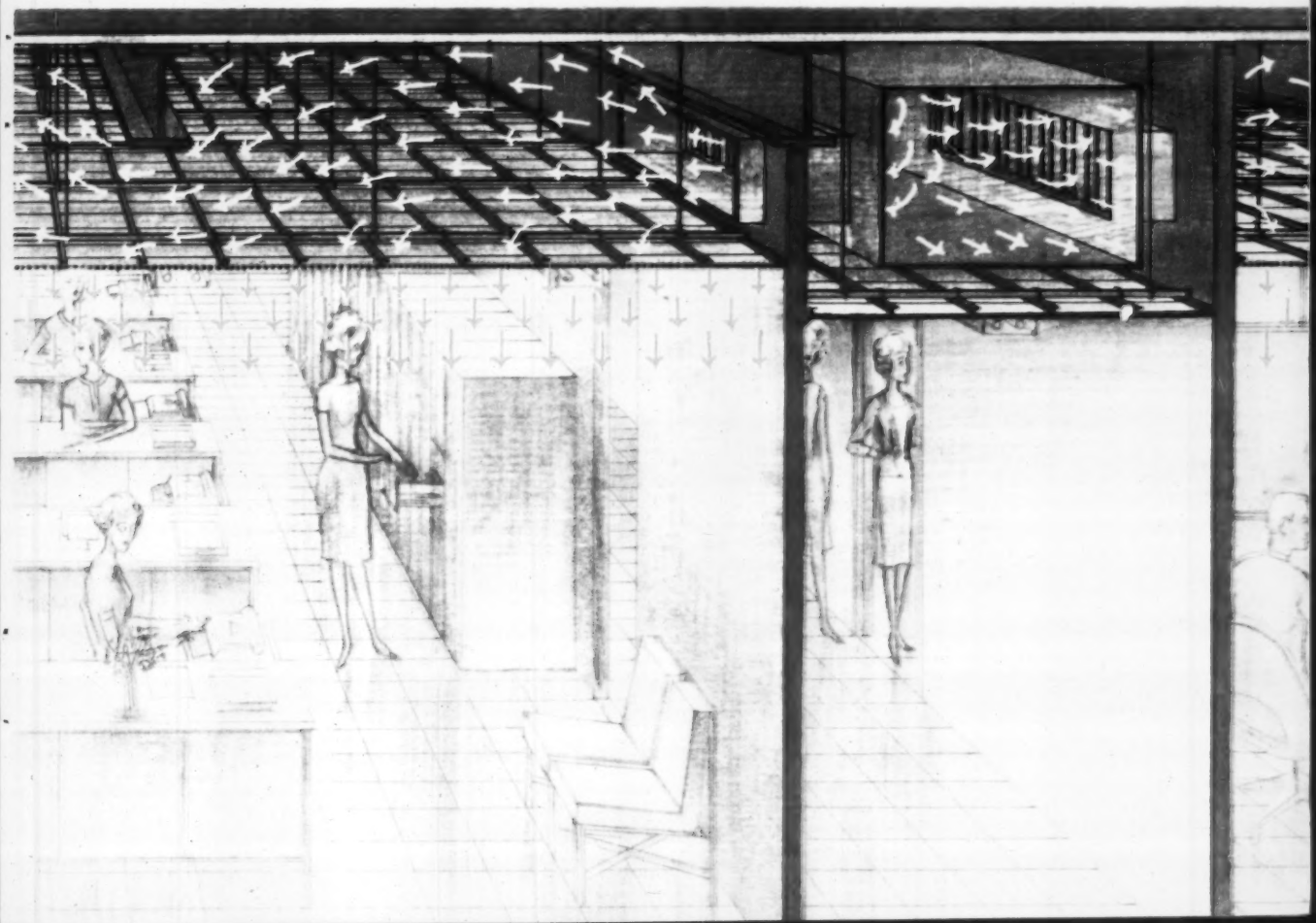


3. They're acoustical—hushing room noises, muffling air-conditioning sounds

Armstrong Ventilating Ceilings have the same high acoustical properties as other Armstrong Acoustical Materials. Noisy air diffusers are, of course, eliminated. And the suspended ceiling separates occupants from any noise that might be transmitted through air-conditioning supply ducts.

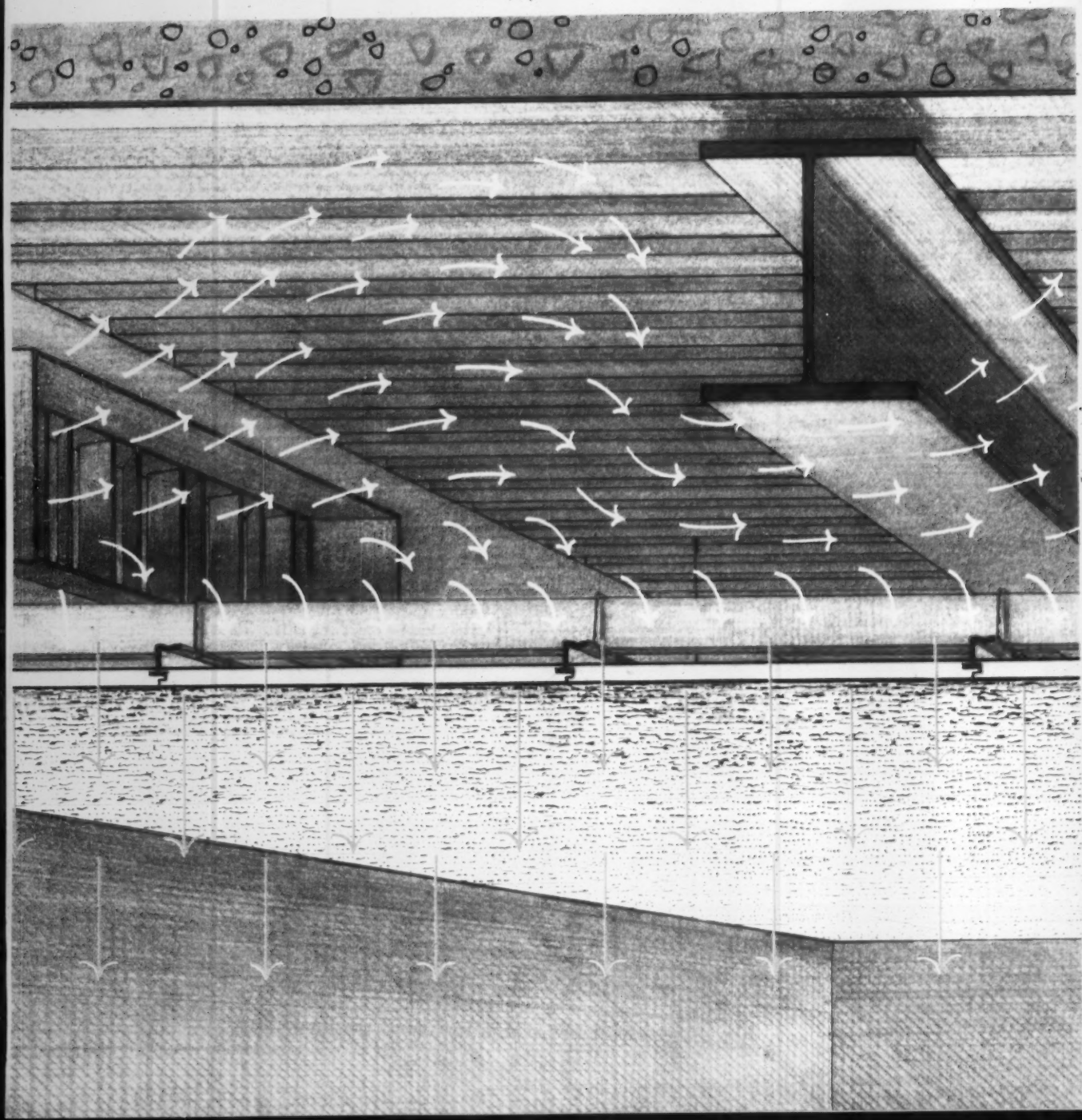
4. The ventilating ceiling can incorporate time-design-rated fire protection

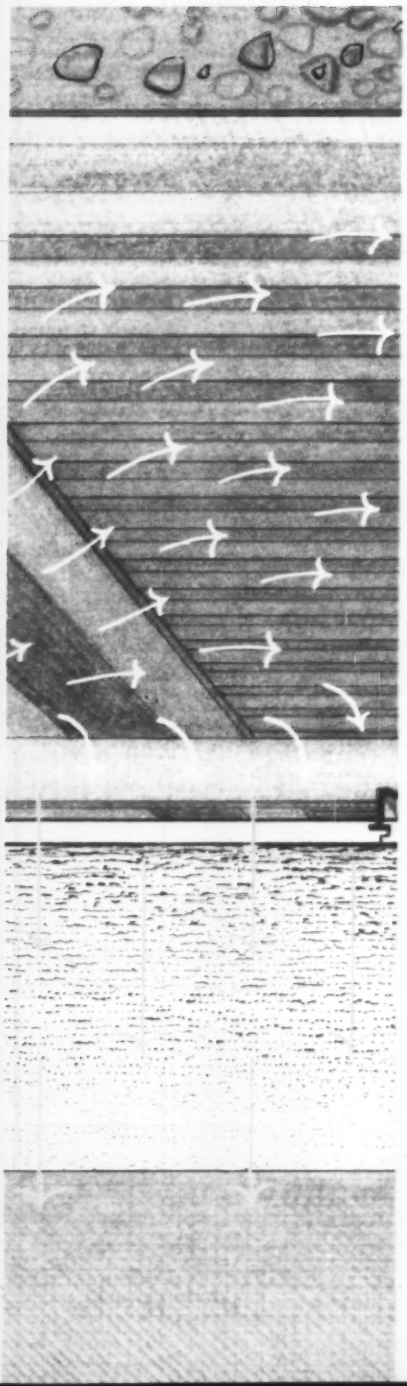
Armstrong Acoustical Fire Guard is available for use in Ventilating Ceilings. Floor-ceiling assemblies, using Ventilating Fire Guard throughout the ceiling, have been tested at Underwriters' Laboratories. The tiny ventilating perforations in the ceilings accounted for over-all open areas of two per cent. Beam-protection ratings up to four hours have been obtained for Ventilating Fire Guard Tile (UL Report 4177-6), and up to three hours for Ventilating Fire Guard Lay-In (UL Report R-4177-7).



ARMSTRONG VENTILATING CEILINGS

their technology





1. The plenum chamber acts as the duct... the ceiling acts as a diffuser

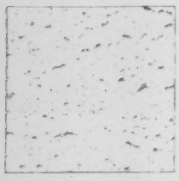
This system is remarkably simple in principle. As the sketch demonstrates, conditioned air enters the plenum chamber through the supply-duct stub by a low-pressure air-inlet system. It is dispersed throughout the chamber and is forced down through the ceiling into the room. Any conventional return-air system may be used with Armstrong Ventilating Ceilings. The system has proven very effective even in large plenum chambers. For example, in one installation, air was projected across 80′ in a 22″ plenum (despite the obstruction of 14″ I-beams) and achieved uniform distribution in the area below.

2. Special plenum-engineering data available

This data provides all the necessary factors and formulae for the correct design and engineering of plenum chambers where Armstrong Ventilating Ceilings are used as the air-inlet system. This step-by-step procedure has been specially developed for the use of ventilating engineers, and is available through your Armstrong Acoustical Contractor or Armstrong District Office.

DATA ON ARMSTRONG VENTILATING CEILING MATERIALS

For complete information on Armstrong Ventilating Ceilings, call your Armstrong Acoustical Contractor or one of the Armstrong Offices listed below. Or write to Armstrong, 4200 Miller St., Lancaster, Pa.



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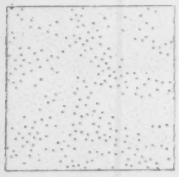
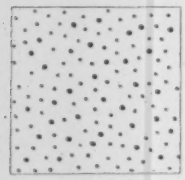


CLASSIC



FULL RANDOM

Travertone.

12"x12" fissured, mineral-wool tile, with square or beveled edges.

Minatone.

12"x12" mineral fiber tile in the Classic and Full Random designs, with beveled edges.

Minaboard Lay-In.

Nominal 24"x24" and 24"x48" units in the Full Random and Classic designs for exposed grids.

Fire Guard.

12"x12" fire-retardant tile in the fissured, Classic and Full Random designs with beveled edges.

Fire Guard Lay-In.

Nominal 24"x24" and 24"x48" units in the Classic design for Fire Guard grid.

Travertone, Minatone® and Minaboard® are trademarks of Armstrong Cork Company.

Some recent installations of Armstrong Ventilating Ceilings:

Battle Creek Country Club, Battle Creek, Mich.
architect: Haughey, Black and Williams, Battle Creek
mechanical engineer: Meckler Engineering Co., Toledo, Ohio
general contractor: Phelps-Wagner Builders, Battle Creek
acoustical contractor: B. C. Schuemann Co., Battle Creek

Dinwoodey Furniture Company, Salt Lake City
architect: Snedaker-Budd-Monroe & Associates, Salt Lake City
mechanical engineer and contractor: Richard C. Brown, Mayne Plumbing and Heating, Salt Lake City
general contractor: Cannon Construction Co., Inc., Salt Lake City
acoustical contractor: Utah Pioneer Corp., Salt Lake City

Northern Federal Savings and Loan Association, St. Paul, Minn.
architect and ventilating engineer: Associated Architects and Engineers, Inc., St. Paul
mechanical contractor: Pierre Aircon Co., St. Paul
general contractor: William Baumeister Construction Corp., St. Paul
acoustical contractor: St. Paul Linoleum and Carpet Co., St. Paul

Arizona Bank, Home Office Motor Bank, Phoenix
architect: Lester Byron, Phoenix
general contractor: Ray P. Petersen Contractor, Inc., Phoenix
acoustical contractor: Barrett-Homes Contractors, Phoenix

Armstrong General Office Building, Lancaster, Pa.
consulting engineer: Charles S. Leopold, Inc., Philadelphia
mechanical contractor: B&G Olsen Co., Inc., Richmond, Va.
acoustical contractor: Berger Acoustical Co., Inc., Haverford, Pa.

Lit Brothers Restaurant, Philadelphia
architect: O. L. Fallan, AIA, Philadelphia
chief designer: John Jones, Philadelphia
acoustical contractor: Berger Acoustical Co., Inc., Haverford, Pa.

John Deere Office Building, Moline, Ill.
architect: R. B. DeJeager, company architect, Moline, Ill.
ventilating engineer: Ward Jensen, company engineer, Moline
general contractor: Axel Carlson Company, Moline
acoustical contractor: Builders Sales & Service Co., Moline

4747 Building, Phoenix
architect: Ralph Haver & Asso., Phoenix
mechanical engineer: Lowry & Sorensen, Phoenix
general contractor: Gilbert & Dolan, Phoenix
acoustical contractor: Barrett-Homes Contractors, Phoenix

St. Paul's Church Home, Inc., St. Paul, Minn.
architect: Buetow and Associates, St. Paul
mechanical contractor: Healy Plumbing & Heating Co., St. Paul
general contractor: J. S. Sweitzer & Son, St. Paul
acoustical contractor: St. Paul Linoleum and Carpet Co., St. Paul

Armstrong offices

ATLANTA, GA.
727 West Peachtree St., N.E.
TRinity 5-7201

BOSTON, MASS.
200 First Avenue, New England Industrial Center, Needham Heights 94. HIllcrest 4-5700

CHARLOTTE, N. C.
1127 East Morehead Street.
EDison 3-7741

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6535 West Irving Park Road.
PEnsacola 6-9440

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DALLAS, TEXAS
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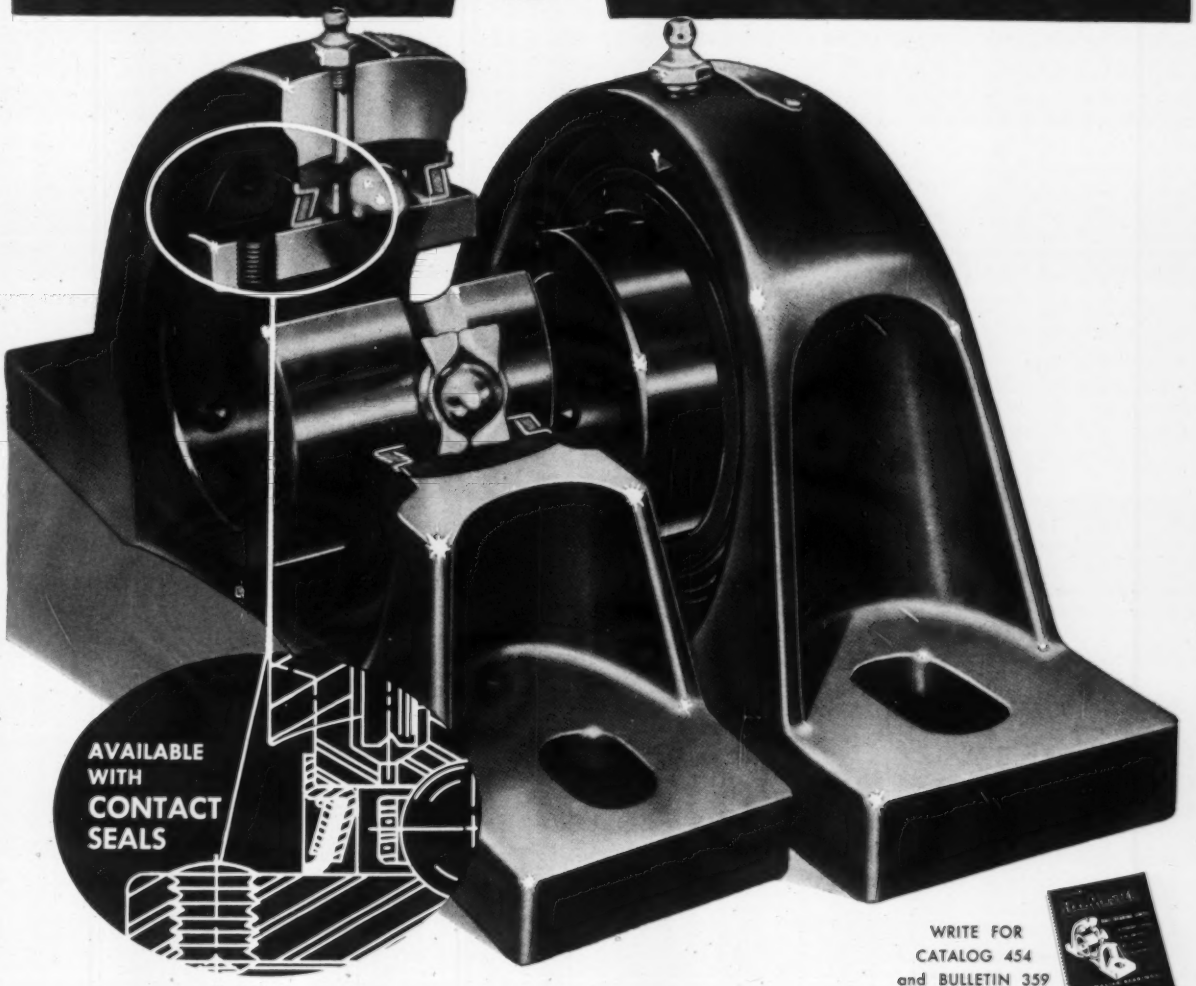

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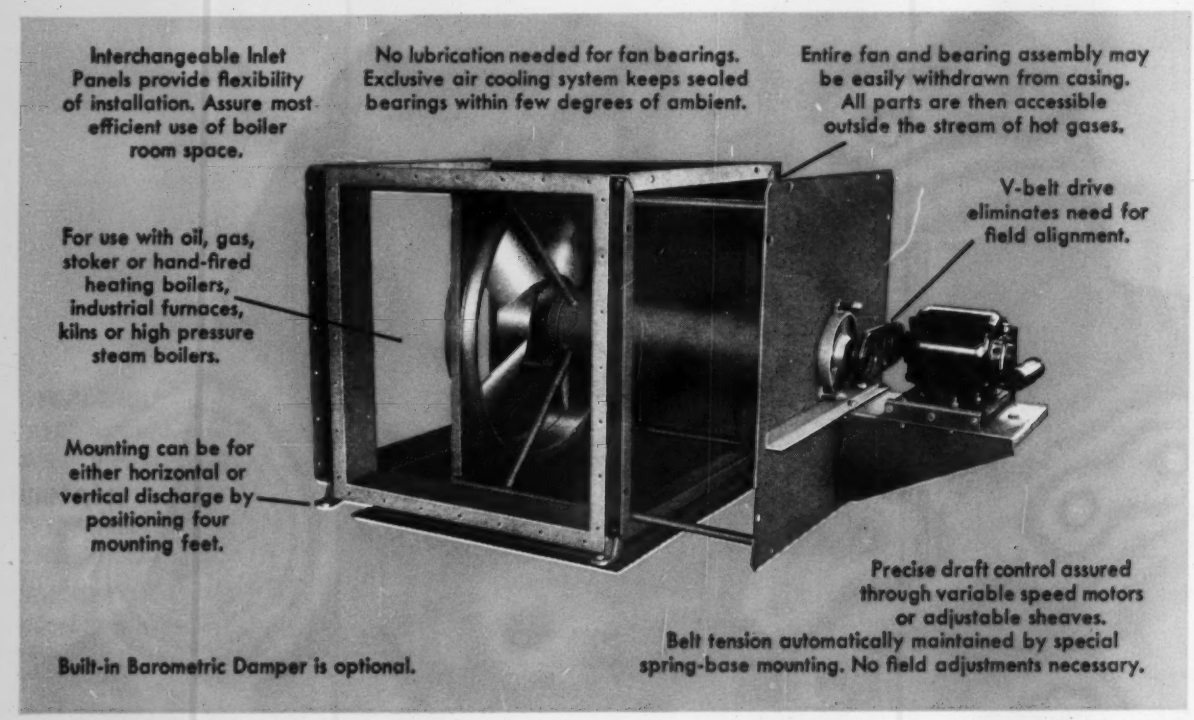
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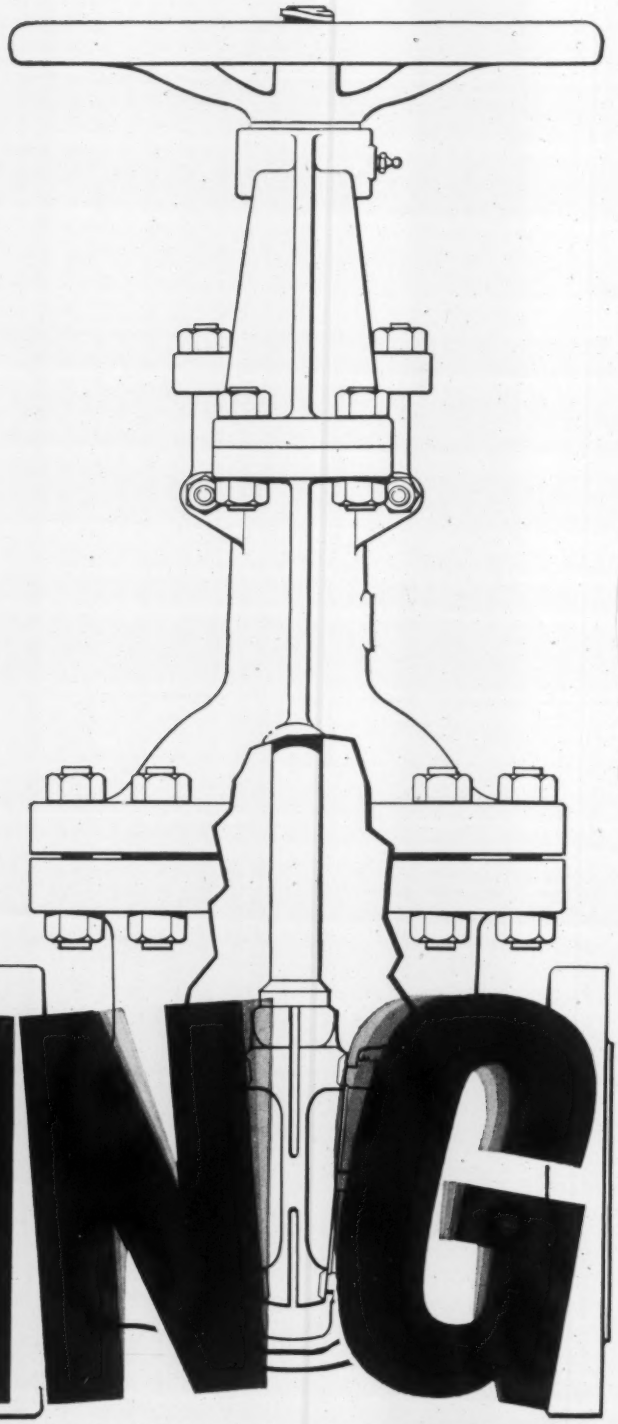
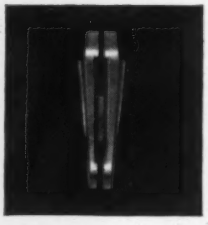
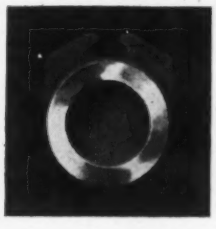


LIVING

Walworth's last word in positive sealing! When valve bodies are tortured out of shape by line pressure, temperature or deflection—new Walworth living wedge Gate Valves still seal tight! It's because of Walworth's unique one-piece split disc gate that lives in the body...flexes and gives, to stay mated to the seat in spite of body distortion. Yet new Walworth living wedge Gate Valve operates at low torque, can't bind, jam or stick—and is economical, needing



WEDGE



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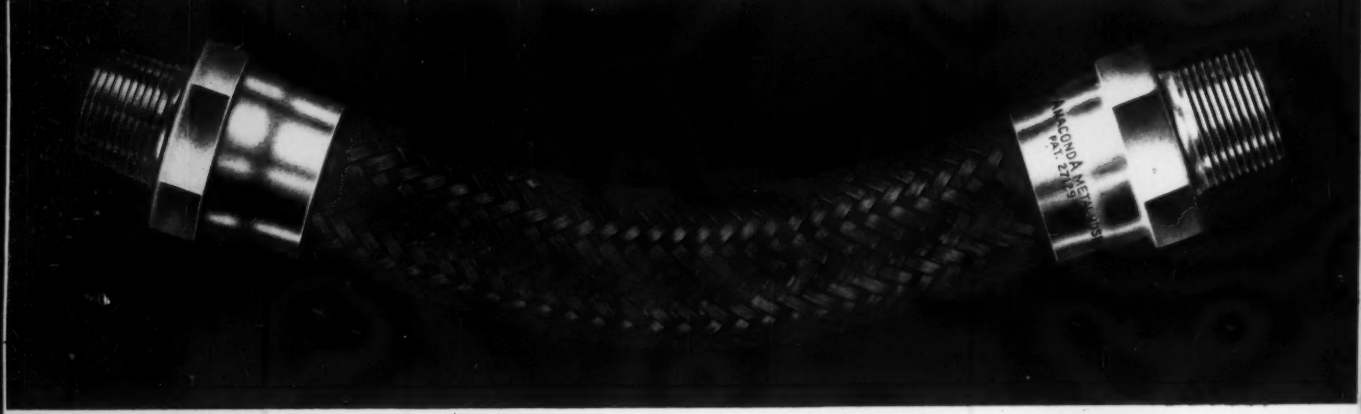
WALWORTH

the Walworth companies: Alloy Steel Products Co.—Conoflow Corporation—Grove Valve and Regulator Co.—M & H Valve and Fittings Co.—Southwest Fabricating & Welding Co., Inc.



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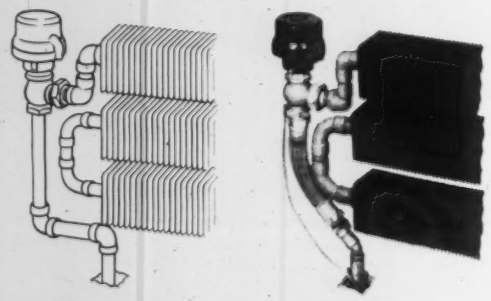
WHERE TO BUY: Leading wholesaler distributors can furnish complete information about Flexpipe in standard sizes. For name and address of distributor serving your area, or for more detailed information, write to: Anaconda Metal Hose, Box 791, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-951

How Flexpipe ends costly, laborious installation of elbows, couplings, short runs of pipe.



RIGID PIPING FLEXPIPE

Flexpipe®

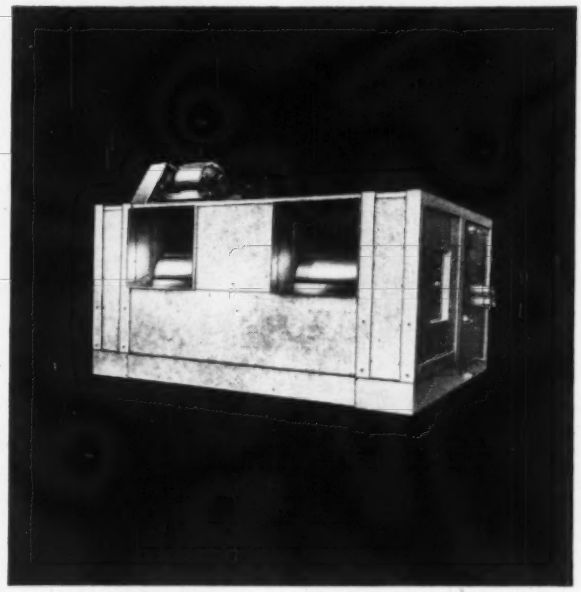
an

ANACONDA®

product

All your air conditioning problems can be solved with one system...from one source

Carrier Central Station Weathermakers—over 50 possible arrangements

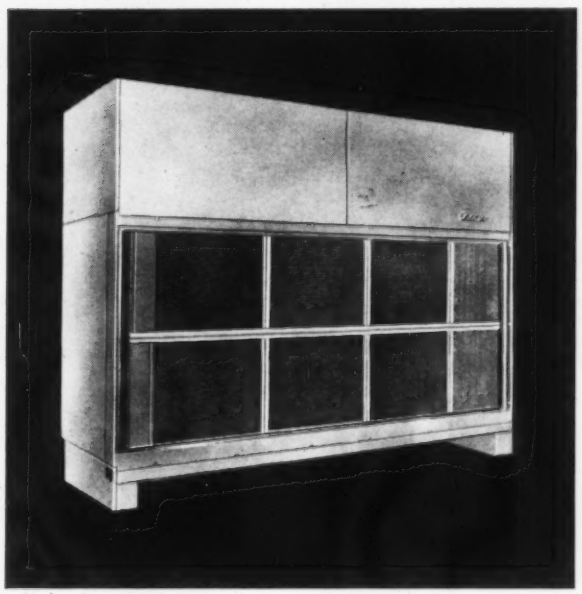


Shown here is the 39AC Weathermaker designed for single-zone applications. It features "building-block" design, which simplifies unit selection and location and permits over 50 different functional and physical arrangements. Choice of direct expansion or chilled water cooling coils; steam or hot water heating coils. Coil face velocities from 300 to 700 fpm; static pressures up to seven inches.

To meet the requirements of smaller conventional jobs, Carrier broadens its central station fan-coil line with three new sizes. In all, you now have a choice of eleven 39AC sizes from 1000 to 40,570 cfm.

The Carrier model 39W Multi-zone Weathermakers provide simultaneous independent cooling or heating in up to 14 different zones. Same sizes, coil face velocities and static pressure as the 39AC; cfm range from 2500 to 40,570.

Carrier Fan-Coil Weathermakers—versatile, economical applications



The 38R Weathermaker* offers many advantages. It has a compact design, a flexible fan section to help simplify installation, and most sizes can be stationed in vertical or horizontal arrangements. Components are protected in an attractive bonderized cabinet.

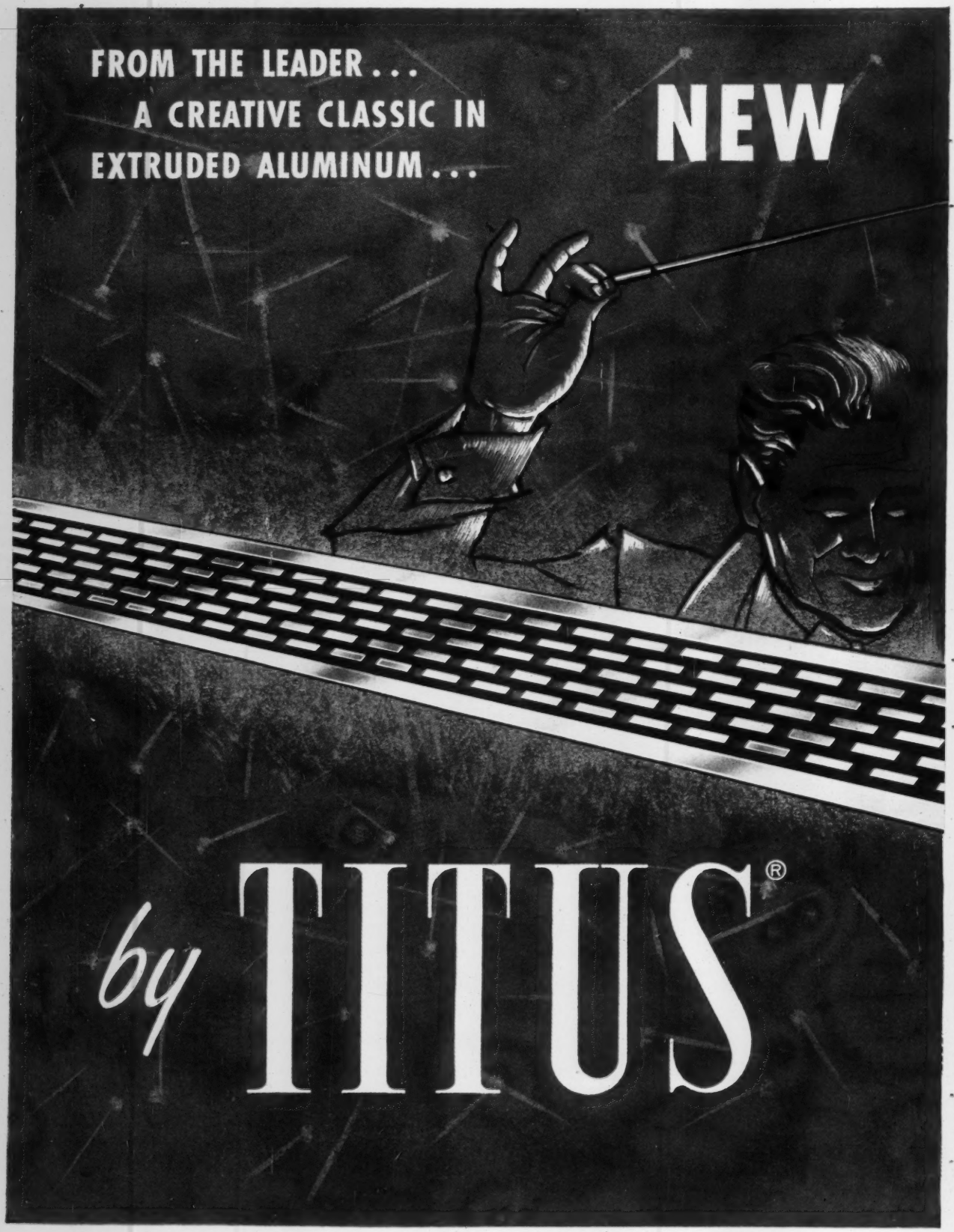
To handle larger air conditioning jobs, Carrier has added two new sizes to its 38R Fan and Coil Direct Expansion line. You now have a wider choice for your requirements. Sizes now available will provide from 1500 to 25,000 cfm.

For summer cooling, 38R Weathermakers may be used with remote condensing unit or liquid chilling packages. Addition of steam or hot water coils convert them to year-round units. They may be used singly or in multiples.

*Reg. U.S. Pat. Off.

For complete details about these products, see the Carrier dealer listed in the Yellow Pages. Or write to Carrier Air Conditioning Company, Syracuse 1, New York.

Carrier ***Air Conditioning Company***


FROM THE LEADER...
A CREATIVE CLASSIC IN
EXTRUDED ALUMINUM...
NEW
by TITUS®

Staccato LINE

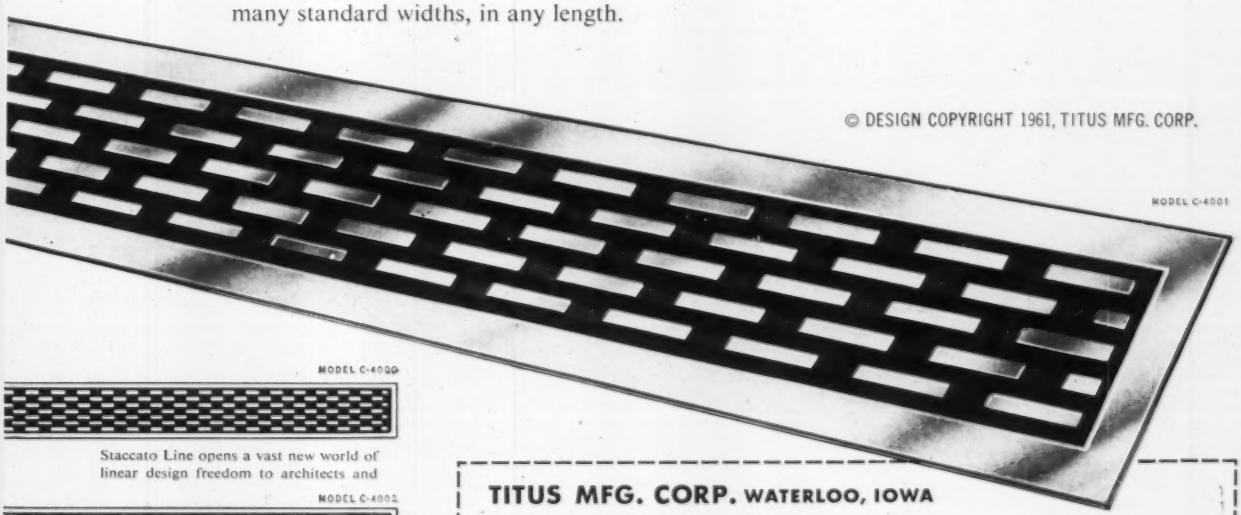
LINEAR AIR DIFFUSERS

Sharp clear notes of vibrant extruded aluminum—highlighted against a recessed background of anodized black. Available in *endless patterns* to harmonize with, or accent, any architectural motif. That's superb new Titus Staccato Line . . . with *design so decidedly different IT GIVES A STARTLING NEW DIMENSION TO THE LINEAR CONCEPT!*

And here's air diffusion efficiency to match the breathtaking beauty! Staccato Line is *perfect for in-line use on sidewall or ceiling* . . . for heating, cooling or ventilating.

Available in a wide variety of extruded aluminum border styles. Furnished in many standard widths, in any length.

© DESIGN COPYRIGHT 1961, TITUS MFG. CORP.

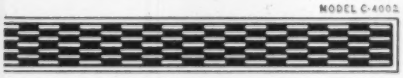


MODEL C-4001

MODEL C-4000

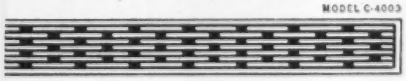
Staccato Line opens a vast new world of linear design freedom to architects and

MODEL C-4002



engineers. Select from an unlimited number of core patterns and border styles to

MODEL C-4003



develop your own individuality of design . . . or match any motif.

TITUS MFG. CORP. WATERLOO, IOWA

Branch Mfg. Plants—Hialeah, Florida Terrell, Texas

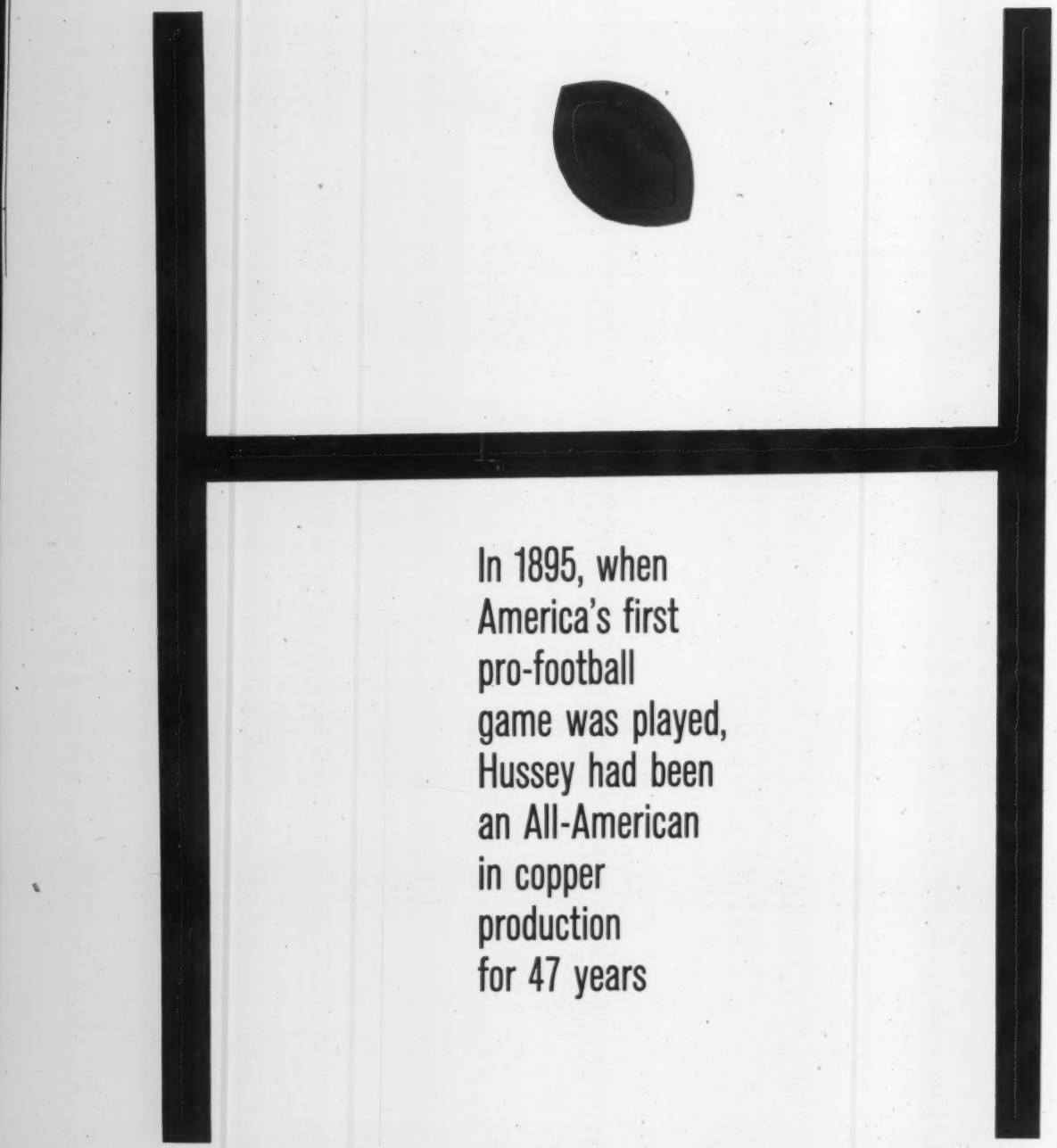
● Rush new free TITUS STACCATO LINE Linear Diffuser Catalog.

NAME_____

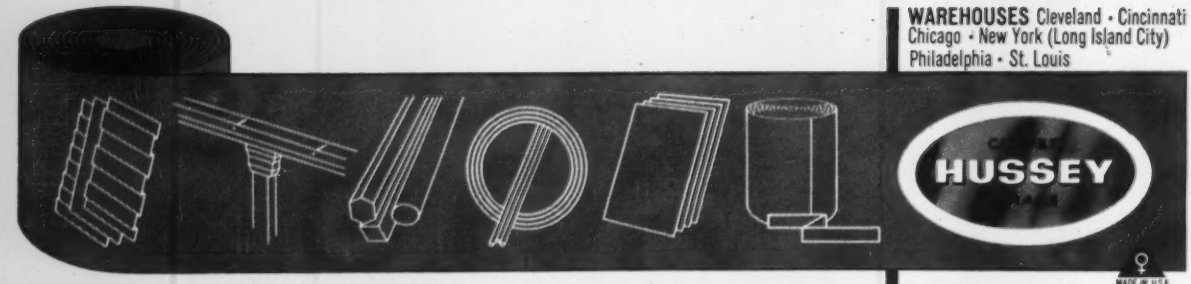
COMPANY_____

ADDRESS_____

CITY_____ STATE_____



In 1895, when
America's first
pro-football
game was played,
Hussey had been
an All-American
in copper
production
for 47 years



WAREHOUSES Cleveland • Cincinnati
Chicago • New York (Long Island City)
Philadelphia • St. Louis

C. G. HUSSEY & COMPANY ▪ PITTSBURGH 19, PA.

DIVISION OF
COPPER RANGE COMPANY

MADE IN U.S.A.
TO THE STANDARDS
OF AMERICAN INDUSTRY

WAGNER® MOTORS AT WORK

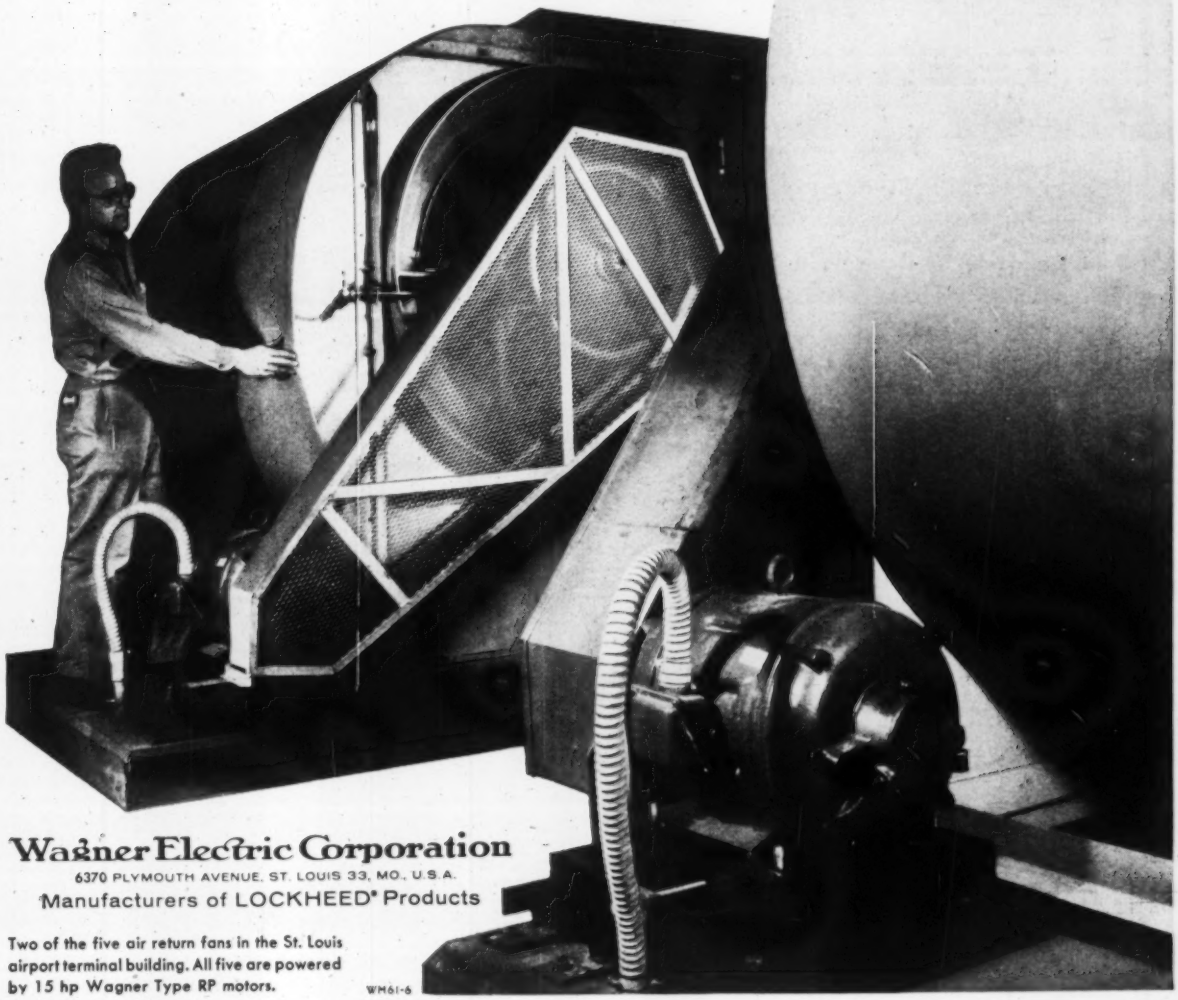
power to ventilate an air terminal

Quiet Wagner® polyphase motors drive air moving equipment at St. Louis' jet age airport

Keeping any building warm in winter and cool in summer is a demanding job. It's a demanding, king-size job in the 50,000 square foot Municipal Airport terminal in St. Louis.

Air movement in this architecturally renowned building is handled by five air supply fans and five air return fans. They're all driven quietly and dependably by Wagner* Type RP motors . . . five 40 hp motors for the air supply fans, and five 15 hp motors for the air return fans.

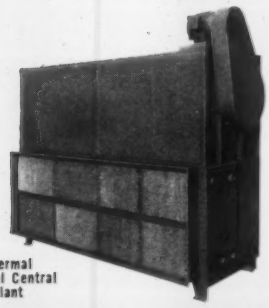
These open type polyphase squirrel-cage motors have the stamina to be perfect drives for fans, pumps, blowers and compressors. They operate for long periods without maintenance . . . efficiently produce power even under critical conditions. Compact and dripproof, they get the job done at St. Louis' jet age airport and in millions of other applications across the country. They can do a job for you. Your Wagner Sales Engineer will be glad to show you how. Call him. Soon.



Wagner Electric Corporation
6370 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.
Manufacturers of LOCKHEED* Products

Two of the five air return fans in the St. Louis airport terminal building. All five are powered by 15 hp Wagner Type RP motors.

WM61-6



Thermal
Vertical Central
Plant

First National Bank, Fort Myers, Florida

Corpus Christi State National Bank, Corpus Christi, Texas

Satisfaction with THERMAL

that can't be discounted

Numerous Bank Buildings Depend on Thermal for Comfort

As the reputation for quality and dependability of Thermal air conditioning and ventilating equipment becomes known, more and more banks, as well as all other types of buildings, are using Thermal.

This is equipment with quality to give satisfaction and long life. Design features combine ready accessibility of internal components with rugged construction.

For further details on air conditioning and ventilating equipment you can specify with confidence, write for complete catalog and names of nationally known concerns using Thermal. The Thermal line includes central and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils, and air-cooled condensers.

Here are some of the banks using Thermal equipment:

East Lake Branch of Birmingham Trust National Bank, Birmingham, Ala.
Commercial Bank, Andalusia, Ala.
Commercial National Bank, Daytona Beach, Fla.
First National Bank, Ft. Lauderdale, Fla.
Dade National Bank, Miami, Florida
Florida National Bank at Brent, Pensacola, Fla.
First Federal Savings & Loan Bldg., Hattiesburg, Miss.
East Central Branch, Bank of New Mexico, Albuquerque, New Mexico
Bank of Broken Arrow, Broken Arrow, Oklahoma
First National Bank, Muskogee, Oklahoma
First National Bank, Abilene, Texas
First Savings & Loan Bldg., Corpus Christi, Texas
Austin Savings & Loan Co., Austin, Texas
North Austin State Bank, Austin, Texas
Security State Bank, Beaumont, Texas
American National Bank, Beaumont, Texas
Farm-Home Savings & Loan Bldg., Ft. Worth, Texas
Raymondville State Bank, Raymondville, Texas
First National Bank, Rockport, Texas
Bellaire State Bank, Bellaire, Texas
Lockhart Savings & Loan Bldg., Lockhart, Texas
First National Bank, Giddings, Texas
Grove State Bank, Dallas, Texas
San Jacinto State Bank, Houston, Texas
First National Bank, Refugio, Texas
Tyler Bank & Trust Co., Tyler, Texas

Quality Products Since 1945

THERMAL ENGINEERING CORPORATION

2605 W. DALLAS • P. O. BOX 13464
HOUSTON 19, TEXAS

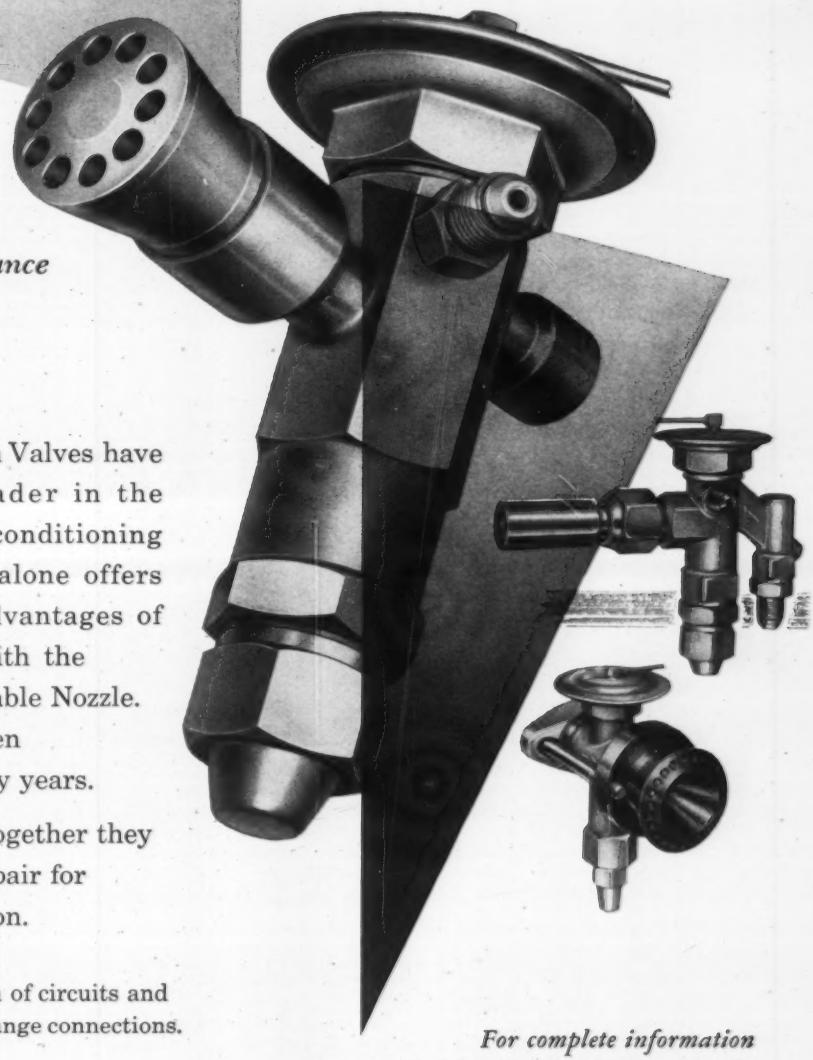
AGENTS IN PRINCIPAL CITIES

SPORLAN

THERMOSTATIC EXPANSION VALVES and REFRIGERANT DISTRIBUTORS

are the **PERFECT PAIR**
for **PEAK PERFORMANCE**

. . . they're
designed
to fit each other
for
smoother performance



Sporlan
Thermostatic Expansion Valves have proved to be the leader in the refrigeration and air conditioning field . . . and Sporlan alone offers you the tremendous advantages of the distributor with the Versatile Interchangeable Nozzle. It too has been the leader for many years.

No wonder then, that together they make the perfect pair for any installation.

Available in any combination of circuits and capacities, in flare, solder or flange connections.

For complete information see your Sporlan Wholesaler or write for Bulletins 10-10 and 20-10 today!

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST. LOUIS 17, MISSOURI
EXPORT DEPT. 85 BROAD ST., NEW YORK 4, N. Y.

FLINTKOTE® **VAN-PACKER®** Refractory Industrial Stacks

Solving Industrial Stack Problems

Van-Packer offers a wide choice of stacks to meet virtually every need

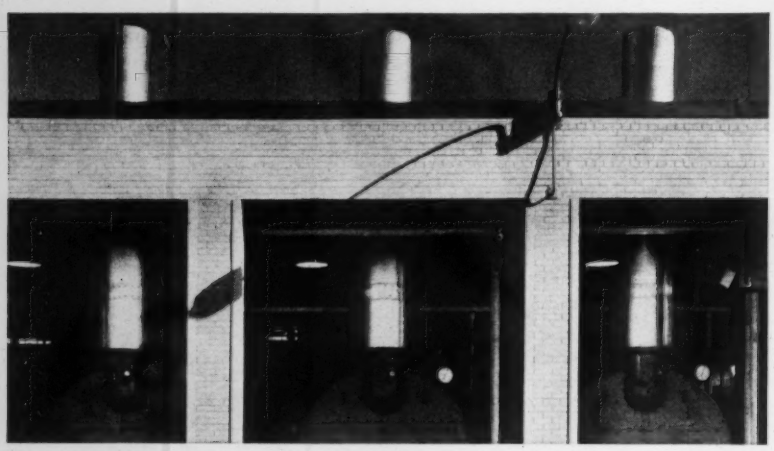
Because Van-Packer refractory stacks are factory-built in modular sections with two types offered, they provide great flexibility to meet varied application requirements.

You can specify any of eight inner diameters: 10, 12, 15, 18, 21, 24, 30, or 36 inches. The 3-foot sections assemble to heights up to 180 feet. They install inside or outside the building, and can be superimposed on the equipment served, floor supported, installed on concrete or brick pier foundations, or supported by wall brackets. Breechings are made with Van-Packer straight sections.

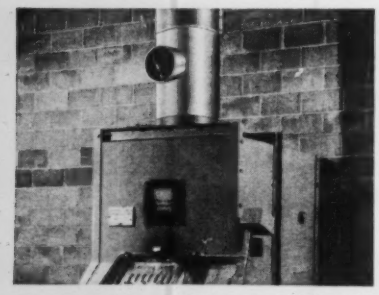
Underwriters' Laboratories, Inc. ® INSPECTED Van-Packer Model HT Smokestack

Van-Packer Model HT Industrial Stack is the only stack listed under the Factory Inspection and Label Service Program of Underwriters' Laboratories, Inc. for commercial and industrial incinerators, boilers and furnaces.

Van-Packer Model BF stack (not UL-listed) is a low cost refractory stack for boilers and furnaces with flue gas temperatures up to 800°F.



Three Van-Packer 30-inch I.D. Model BF Industrial Stacks on these boilers provide highly efficient, low-cost installation at this Chicago-area high school. Refractory construction of these stacks provides high draft for efficient operation of the equipment. Stack cost is about the same as steel stacks for the same application, yet the non-corroding refractory of the Van-Packer provides an average stack life three times greater than steel stacks. An aluminized steel jacket which encases each 3-foot stack section requires no painting.



A Van-Packer Model HT Industrial Stack serves incinerators with flue gas temperatures to 1800°F — or 2000°F for brief periods of forced firing.

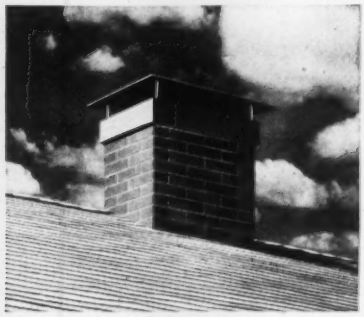
For complete information on Van-Packer Industrial Stacks, please write for Bulletin IS-49. Your copy will be sent promptly.

Stack installs inside or outside

Van-Packer stacks are easily installed on outside walls of buildings to serve the equipment.

An insulated thimble, flashing and counter flashing offered with Van-Packer stacks lets you safely design for inside installation with minimum clearance, even through combustible floors and roof.

For residential use specify Van-Packer all-fuel chimney



Here's a low-cost, factory-built tile-lined residential chimney that's safe and attractive. Specify either metal or asbestos-cement housing with embossed brick design. Choice of four nonfade brick colors: red, white, buff, and gray. Factory-built 2-foot flue sections have 5/8-inch fire clay tile liner, 3-inch vermiculite-concrete insulating wall, and asbestos-cement outer jacket. Van-Packer chimney is UL-listed for all fuels, is safe for incinerators. Write for Bulletin RS-1.

FLINTKOTE® VAN-PACKER®

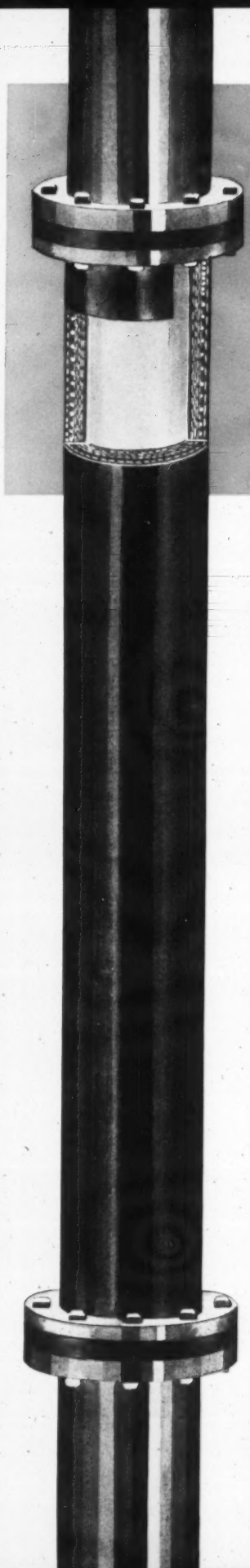
The Flintkote Company

Manufacturers of Diversified Products for Home and Industry

30 Rockefeller Plaza, New York 20, N. Y. Phone: PLaza 7-5500

In the West: Pioneer Division, The Flintkote Company, P. O. Box 2218, Terminal Annex, Los Angeles, Calif.

In Toronto, Ontario: The Flintkote Company of Canada, Ltd.



How to DAMPEN DECIBELS

and stop vibration that shakes piping to pieces

with

MERCER RUBBER

VIBRAFLEX

Pipe

Cut down on costly damage caused by vibration and gain the benefits from noise elimination.

Mercer VIBRAFLEX rubber pipe works at the point where noise and harmful vibration begins—right off the compressor or pump. VIBRAFLEX pipe *eliminates* water line noises and absorbs "water hammer." And there are extra benefits—it permits compensation for misalignments and positively prevents electrolytic action by eliminating any metal-to-metal contact. Available in styles up to 250 psi, in sizes from 2 to 12 inches and lengths from 6 to 60 inches.

There's nothing else available quite like Mercer VIBRAFLEX pipe with its helical spring steel wire which prevents kinking, crushing or collapsing. Of course, there's more to the story than this—so why not write now for complete specifications. STOP lowered efficiency due to noise, cancel out harmful vibration—put VIBRAFLEX pipe to work. Get the Facts NOW!

SINCE 1866

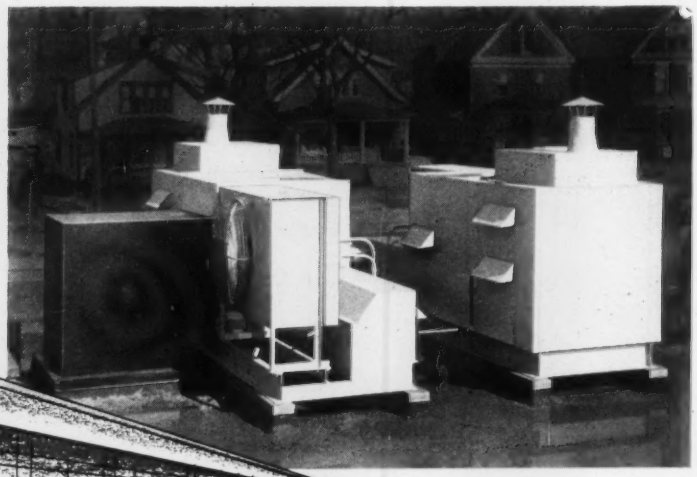
M RC

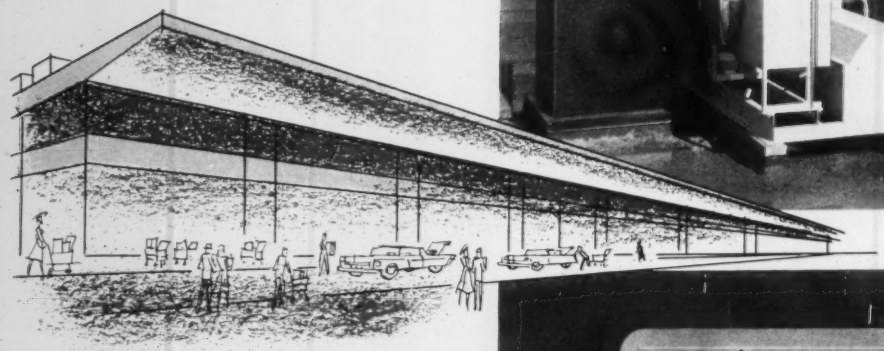
MERCER RUBBER CO.

136 MERCER ST., TRENTON 90, N. J. • JUniper 7-1200 • TWX: MERV 8512

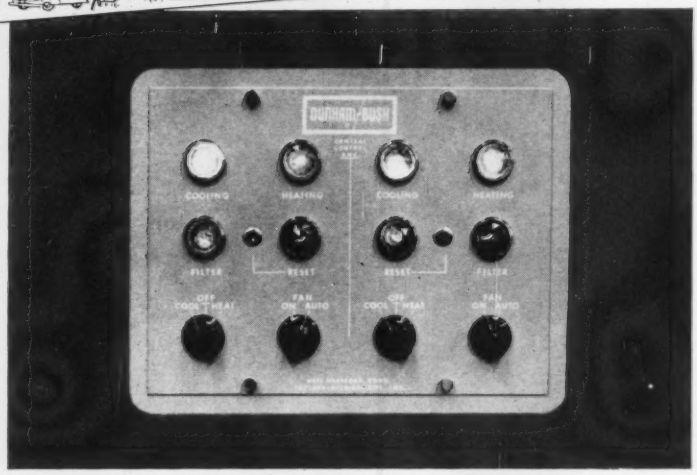
NOW...

Complete Control of Comfort from





WITHIN THE CONDITIONED AREA with



ROOF MOUNTED AIR CONDITIONERS by DUNHAM-BUSH

Dunham-Bush 'RMC' roof mounted conditioners, developed to meet the ever increasing need to save floor space in conditioned areas, are now available with a central control station which permits "direct dialing" comfort control from within the conditioned area.

Panel control provides for easy heating or cooling adjustment and automatic push button reset . . . prevents tampering . . . saves time . . . reduces maintenance. Pilot lights provide complete visual indication of system's operation: indicator light advises when filter needs replacing.

Central control station can be used to govern operation of several units serving a single zone, or to control a single unit serving several zones.

'RMC' units are available in 5, 7½, 10 and 12½ ton models and are easily installed atop any single story building. Heating or cooling is immediate at the flick of a switch. Air cooled, 'RMC' units require no plumbing or piping connections, are furnished completely factory wired, with all interior plumbing assembled. Units can be furnished for use with remote diffuser applications.

It will pay you to investigate this modern, economical air conditioning-heating system. Form No. 6023A, free on request, contains complete details.

DUNHAM-BUSH

DUNHAM-BUSH, INC.

WEST HARTFORD 10, CONNECTICUT, U. S. A.

SALES OFFICES LOCATED IN PRINCIPAL CITIES

Presenting—

—a new concept in welding fittings

It's the NEW

TAYLOR FORGE
COMPACT LINE

for greater economy in heating/cooling system piping

T F
TRADITIONALLY DEPENDABLE

FACTS FOLLOW

90° ELBOWS

45° ELBOWS

STRAIGHT TEES

For the first time...fully dependable... reduce costs..

Functional Design At a Glance

These photographs show the dimensional differences between Compact Fittings and corresponding conventional fittings. The Compact 90° elbow is contrasted with a conventional long radius elbow which is by far the most commonly used type. Dimensions of the Compact 90° elbow are the same as those of the regular Taylor Forge short radius (1-R) WeldELL. The lower cost of 90° Compact elbows is made possible by large volume runs of a limited number of sizes, each in a single thickness, and particularly by new and improved mass production methods. The 45° elbow has heretofore been obtainable only in the long radius pattern.

What we have here is one of those "why-didn't-someone-do-it-before" ideas. By providing new designs and new dimensions as shown in the accompanying illustrations, the new Taylor Forge Compact Line of welding fittings truly represents the first major break with tradition in the 30-odd years since welding fittings were first introduced in America.

But you can be sure that although the designs and dimensioning have been changed, there has been no change whatever in the quality standards and manufacturing integrity that have been traditionally associated with Taylor Forge products for more than a half century.

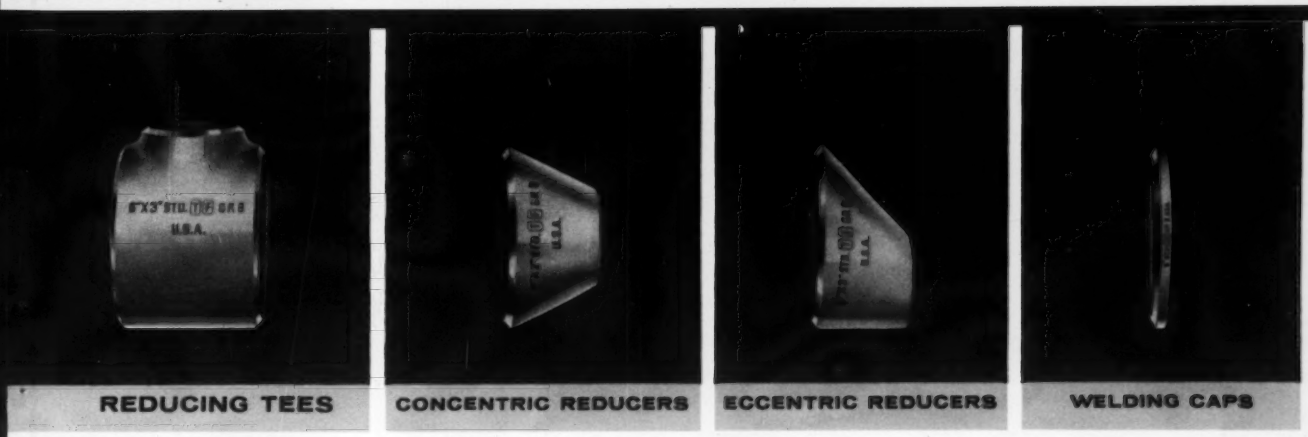
The new designs and reduced dimensions permit simplified and improved mass production methods and lower manufacturing costs. More compact design and reduced weight also bring important savings in shipping, trucking, storing, on-the-job handling and installation.

Common though functional design has been in other fields, it remained for Taylor Forge to apply to welding fittings the principle of designing and dimensioning *functionally* . . . for *savings*.

Rugged Strength

Taylor Forge Compact Fittings are *seamless*. They are of nominal Standard (Schedule 40) wall thickness. Ends are accurately beveled and sized to match corresponding Schedule 40 pipe. Only Grade B carbon steel is used in making them.

Because they are designed for heating/cooling system piping and similar low or moderate pressure service, they are arbitrarily designated as Class 125 and therefore carry the customary WOG rating of 175 psig (125 psig for saturated steam). The cyclic and bursting tests on the last page of this advertisement will show you how conservative this rating is.



REDUCING TEES | CONCENTRIC REDUCERS | ECCENTRIC REDUCERS | WELDING CAPS

..American-made welding fittings that ..through functional design

Easy to Weld

Before putting Compact Fittings on the market, tests were made to determine ease of welding. Experienced welders, working under job conditions, found them easy to handle—under many conditions actually more convenient than corresponding conventional fittings.

Adequate Range of Sizes and Types

The Taylor Forge Compact Line, like the fittings themselves, is "streamlined" for greater manufacturing economy. It embraces, nevertheless, practically all of the sizes and types of fittings usually required in heating/cooling system piping.

The line includes 90° and 45° Elbows, Straight and Reducing Tees, Concentric and Eccentric Reducers and Caps, in sizes 2", 2½", 3", 4", 5" and 6". Reducing Tees and Reducers are offered with reductions in the intermediate IPS sizes down to one-half of the nominal run or large end size.

It will be seen that, except for piping around boilers in very large installations, this range of sizes and types is completely adequate. The occasional larger or smaller size that may be needed can be furnished by the same Taylor Forge Distributor from his stock of Standard Taylor Forge Fittings.

Marking

All fittings have complete identification markings and are painted bright orange, as illustrated, with non-toxic, corrosion-resistant paint.

Compact fittings are now carried in stocks for immediate delivery by Taylor Forge Distributors in all important trading centers. Use the coupon to ask for bulletin, and name of your nearest distributor.

WHAT THE COMPACT LINE MEANS:

to the Consulting Engineer: Fittings that can be specified or approved with complete assurance of full strength and service life equal to that of the pipe itself. Uniform excellence and dependability backed by one of America's oldest, largest and most respected manufacturers of products for piping and pressure vessel construction.

to the Mechanical Contractor: No longer is it necessary to "shop around" or perhaps even take chances with foreign made fittings of questionable quality—and with no recourse to the manufacturer when things go wrong. Now you can be sure of *both* high quality *and* utmost economy by choosing Taylor Forge Compact Line Fittings for that next heating/cooling contract.

TAYLOR FORGE COMPACT LINE

Get a seat on the aisle for the curtain raising

... Mail coupon on reverse side

Long Service Life Assured

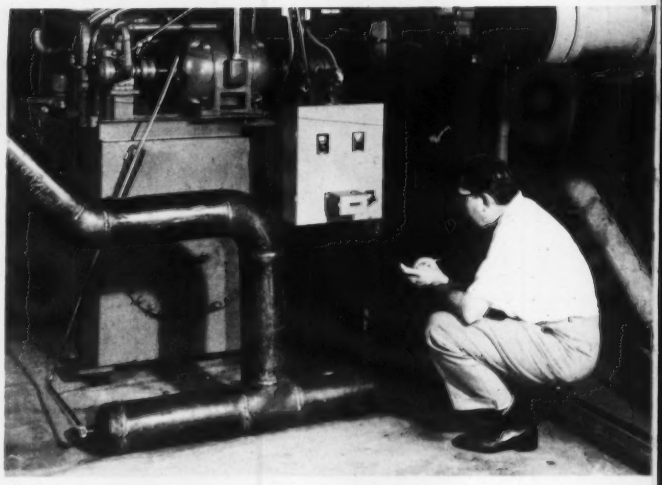
Tests prove strength and quality of TAYLOR FORGE Compact Fittings

The photographs here show a cyclic pressure test of Compact Fittings which gives conclusive proof that they are conservatively rated and that the expected service life of the fittings is equal to that of the pipe itself.

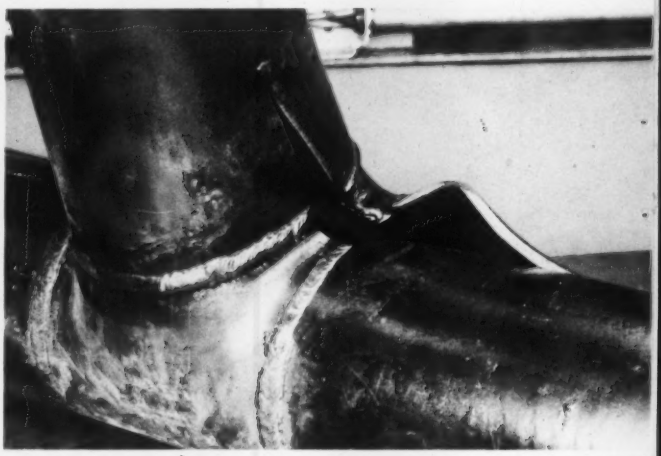
The test unit was fabricated from 4″ and 6″ Standard Thickness (Schedule 40) Grade B pipe and includes a 6″ x 6″ x 6″ Tee, a 6″ 90° Elbow, a 6″ 45° Elbow, and a 6″ x 4″ Concentric Reducer—all Compact Line Fittings. In testing, a mean pressure of 875 psig (five times WOG rating) was established as basic pressure. Cyclic pressure variation was from 50% under to 50% over this pressure—in other words, from 437 psig to 1312 psig. The assembly was then subjected to 36,500 of these pressure cycles—the equivalent of one cycle per day for *100 years!*

How did it stand up under this punishment? Upon completion of the cyclic testing, the unit was hydrostatically burst, the break occurring, as it theoretically should, in the crotch of the tee and extending into the adjacent run and branch pipes. Moreover, the unit had to be brought to a pressure of 5200 psi before bursting, yet the theoretical bursting pressure of 6″ pipe is only 5080 psi. After 36,500 pressure cycles this result is rather startling.

This and similar tests conclusively prove the rugged strength and complete dependability of Taylor Forge Compact Line Fittings.



Cyclic pressure test of unit containing Taylor Forge Compact Line Fittings.



Unit hydrostatically burst after 36,500 cycles; bursting pressure 5200 psi—a remarkable demonstration of the high quality of these economical new fittings.

Taylor Forge and Pipe Works

General Offices and Works: P. O. Box 485, Chicago 90, Illinois
Plants: Carnegie, Pa.; Somerville, N.J.; Gary, Ind.; Houston, Texas; Fontana, Calif.; Hamilton, Ont., Canada
District Sales Offices: New York, Philadelphia, Pittsburgh, Atlanta, Chicago, Houston, Tulsa, Los Angeles, San Francisco, Seattle, Hamilton, Calgary, Montreal

SEND BULLETIN COVERING NEW TAYLOR FORGE COMPACT LINE FITTINGS

Name _____

Firm _____

Position _____

Address _____

_____

MAIL TO TAYLOR FORGE & PIPE WORKS, P.O. BOX 485, CHICAGO 90, ILL.

COUPON BRINGS COMPLETE FACTS

Mail the coupon for bulletin containing complete facts and tables showing sizes, dimensions, weights of Compact Line Fittings. We will give you the name of your nearest Taylor Forge Distributor stocking the Compact Line.

Printed in U.S.A.

you'll want to know...

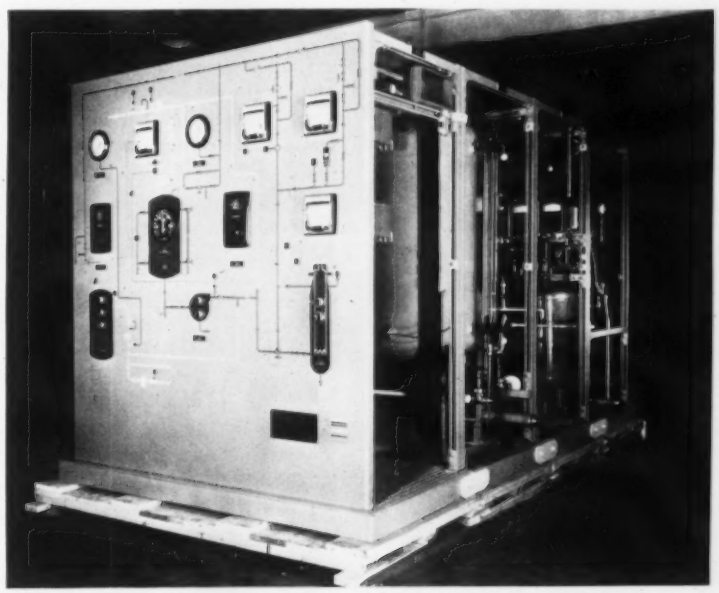
Apprentice Instructors Learn New Teaching Methods At Eighth Annual UA Training Program at Purdue University

NEARLY 400 apprentice instructors of the United Association are now better qualified to do their jobs back home. The reason: New teaching methods learned at Purdue University during the Eighth Annual UA Training Program.

Some 384 instructors gathered at Lafayette, Ind., August 14 to 18, to receive instruction in heating, piping, air conditioning, and plumbing. At the same time, 110 apprentices vied for top honors in the Apprentice Contest, also sponsored by the UA.

One of the key announcements of the five-day meeting was the introduction of a new training manual, *Industrial Instrument and Control Piping*. The manual is published by the National Joint Pipefitter Apprenticeship Committee, composed of representatives of the Mechanical Contractors Association and the UA. The manual's authors are A. M. Adamic, president of Mercury Piping Co., Inc., mechanical, electrical, and instrumentation contractors, Norwood, Mass., and W. H. Furry, director of training for the Foxboro Co., Foxboro, Mass.

Another training aid that was introduced is a portable panel board training unit to be used to provide practical demonstrations of different phases of instrumentation. The unit illustrates remote



THIS NEW control panel will aid UA apprentice instructors to demonstrate the control and measurement of temperature, level, pressure, and flow in industrial piping systems

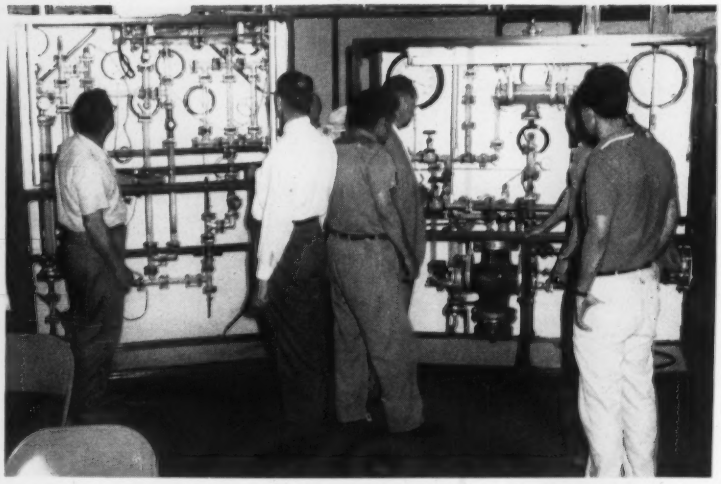
you'll want to know

and local measurement and control of the four basic variables most common in industrial control: temperature, flow, level, and pressure. Information on this unit can be secured from the Mercury Piping Co.

The winners in the apprentice contest, which involved a week-long test of written examinations and laboratory work are as follows:

Thomas A. Bohlman of Local 601, Milwaukee, Wis., walked off with first place and $1000 in the pipefitting competition. His score of 1764 points was enough to outdistance second place winner, Maurice D. McClure of local 597, Chicago, Ill. Mr. McClure amassed a total of 1706 points, enough to win the $500 prize. Third place winner John Kain of local 420, Philadelphia, Pa., totaled 1683 points, and was awarded $250.

In the sprinkler fitter's division, first place honors went to S. P. Herrick of Local 696, Newark, N.J. Fred Langer of Local 281, Chicago, Ill., won second place, and James A. Bernhart of Local 709, Los Angeles, Calif., won third place. The awards for this competition were $500, $250, and $125.



THESE GLASS teaching devices, the one on the left a steam unit and the one on the right a hydronic heating system, typify the ingenuity of the UA training staff in developing teaching aids

Tallest Building West of the Mississippi Has 4200 Ton Air Conditioning System

FOUR 1050 ton steam turbine centrifugal refrigeration machines will cool the new home of the Humble Oil & Refining Co. in Houston, Tex., when it is completed next year. The 601 ft building is comprised of three levels located below ground and 45 floors above street level. It contains approximately 1,300,000 sq ft of floor space.

A seven story garage building, which is adjacent to the office building, will also house the central power plant and water chilling systems serving the entire building network. The equipment is located on the seventh floor.

There is also a mechanical equipment room on each of the basement levels of the office building and each of the ninth, 21st, and 33rd floors. In addition, the 44th and 45th floors contain equipment installations. The upper level equipment rooms consist essentially of factory assembled air handling units, built-up high pressure air conditioning systems, and local pumping and heat conversion equipment. From these areas, properly treated conditioned air will be distributed to the building.

The mechanical contractor for the project is the Sam P. Wallace Co., Inc. The general contractor is W. S. Bellows Construction Corp.

Antelline Engineering Co. Designed Radar Tracking Station Air Conditioning Systems

THE Antelline Engineering Co. should have been mentioned as the air conditioning system designers in the article, *Air Conditioning Stabilizes Missile-Tracking Antennae*, by Lester S. Ries, in the September issue. The information for the article was provided by the Antelline organization to Mr. Ries, a member of HPAC's board of consulting and contributing editors, who prepared the article for publication in the September issue. The editors regret that this omission in the article was made.

Stainless Steel Pipe Carries Steam from Geysers To Generate Electric Power

ANOTHER source of power has been harnessed by the United States. Now, for the first time in this country, commercial electric power is being generated from natural steam from a geyser.

Site of the new power source is the Pacific Gas and Electric Co. in Sonoma County, Calif. — about 90 miles north of San Francisco. Called "The Geysers Power Plant," it has a capacity of 25,000 kilowatts.

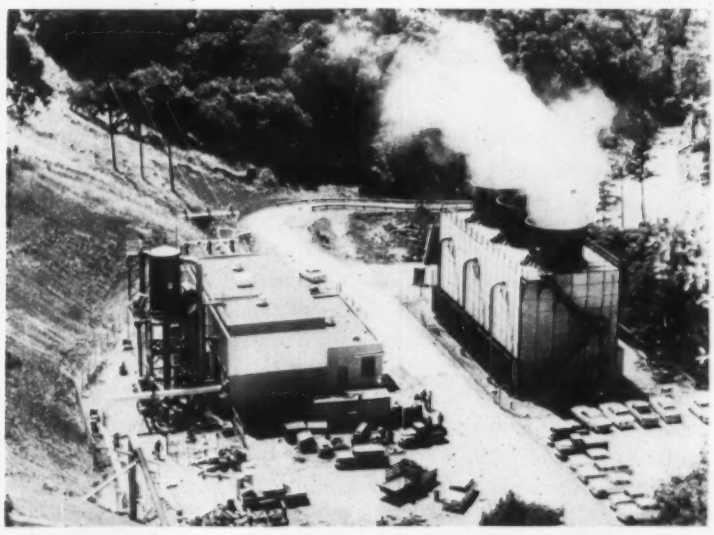
A stainless steel pipeline takes steam from four 600 ft deep wells and carries it over a hill a quarter mile to the plant. There the steam jets against turbine blades in much the same way as if the steam had been generated in a boiler.

One big problem at The Geysers was how to stop corrosion of equipment. After various tests made on a scale model of the plant, it was decided that the use of chromium-nickel stainless steels would solve this problem, according to the International Nickel Co., Inc.

Steam and gas seem to come to all the wells from a common source. The gas is composed chiefly of carbon dioxide, methane, hydrogen, nitrogen, hydrogen sulfide, and ammonia. A two-stage gas ejector, with inner and outer condensers, is used to remove these non-condensable gases. The condensers are fabricated from carbon steel with an inside cladding of Type 316 stainless steel. The gas ejectors, connection piping, and internal parts of the condenser are all solid Type 316.

Since it is not necessary to recover the condensed steam after its energy is spent, the plant uses an inexpensive barometric-type condenser. Type 304 stainless steel is used in the exhaust duct from the turbine to this condenser, and in the circulating water pumps.

The plant is designed for unattended operation.



THE Geysers Power Plant, America's first use of geothermal power

Greenhouse Heating System Maintains 65 F With -40 F Outdoor Temperature

WITH winter temperatures in Moose Jaw, Saskatchewan, Canada, sometimes going as low as −40 F, building a greenhouse in the area has certain inherent problems in controlling the temperature.

Such was the case of the Valley Park Greenhouse, Ltd., one of the newest and largest floral greenhouses in the 900 mile Canadian stretch between Medicine Hat, Alberta, and the Great Lakes.

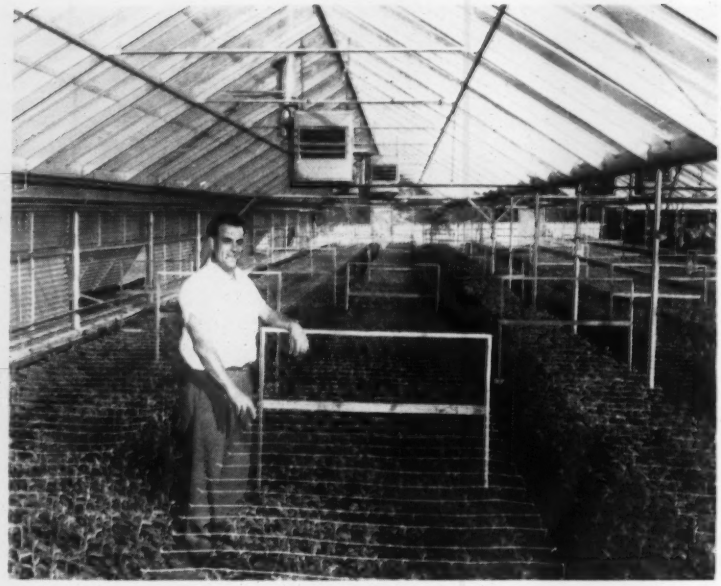
A temperature of 65 F has to be maintained in the building at all times. If some malfunction of the system prevents this temperature from materializing, the flower crop will be destroyed. For this reason, it was decided that gas-fired unit heaters would be used, figuring that if one unit had to be repaired, the other units could make up the difference in maintaining the desired temperatures.

A second problem was caused by a local regulation requiring any installation using an excess of 1500 cfh of gas to make their purchase on an interruptable basis, at lower cost. Therefore, the unit heaters had to be dual-fuel units. In this case, they have provisions for using LP gas.

Further requirements involved a supply of outside air to replenish oxygen. Also, system construction had to be able to withstand high humidity conditions.

The installation is constructed of plastic with an all-steel frame. The plastic has a "U" factor of 1.77. Heat loss is calculated at 10,000,000 Btu per hr.

Fifty unit heaters make up the main portion of the heating system, and a 60 hp packaged steam boiler handles periphery heating. An additional eight unit heaters supply outside air, according to Reznor Mfg. Co. All heaters are controlled automatically by special corrosion resistant thermostats, and are vented with separate vent stacks through the roof. A propane air mixing plant for dual-firing purposes completes the system.



UNIT HEATERS are suspended from the all-steel frame of one of Canada's largest greenhouse installations. Seen in the foreground is Leslie Evans, co-owner

An interesting point about the system is that as the temperature decreases, the frost on the outside of the plastic increases, thereby decreasing the heat transmission from the structure.

New Trade Association Is Born:

Air Diffusion Council

A NEW trade association in the air distribution field has been established. Named the Air Diffusion Council, it is incorporated under the laws of Illinois.

The prime objectives of the new group will be in the areas of testing and rating standards, and research.

Officers elected at the first meeting to serve during 1961-62 are: R. D. Tutt, Tuttle & Bailey, president; P. F. Canavan, Connor Engineering, vice president; D. L. Titus, Titus Mfg., secretary; and C. T. Roff, Anemostat Corp. of America, treasurer.

Charter members are: Anemostat Corp. of America, Buensod-Stacey, Carnes Corp., Connor Engineering Corp., Titus Mfg. Co., Tuttle & Bailey, Div. of Allied Thermal Corp., and Waterloo Register Co.

Air Diffusion Council is managed by Smith, Bucklin & Associates, professional trade association management firm. The address of the Council is 333 N. Michigan Ave., Chicago 1, Ill.

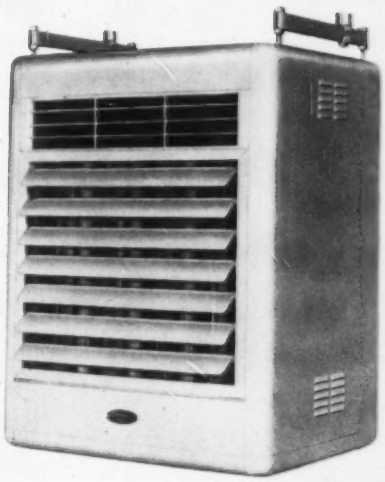
When You | *SELL or REPLACE*

UNIT HEATERS or DUCT FURNACES

ORDER

Hastings

Because They **DO NOT** ***RUST*** or ***BURN OUT*** and **Are Fully Guaranteed For 10 Years!**



BLOWER MODELS

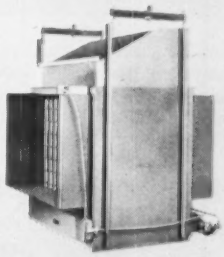
For extremely quiet operation.

Open or Enclosed Blower Models.

DUCT FURNACES

May be close-coupled for any total capacity.

Low air pressure drop.



THE SUPER-FEATURE LINE

Fan Models — Blower Models

Duct Furnaces

25,000 to 900,000 Btu's

Aluminized or Stainless Steel

Industrial and Make-up Air Heating

Heavy 18 Gauge 100% Welded

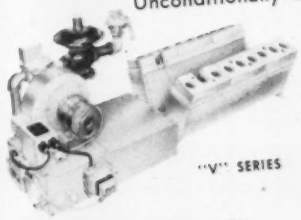
Duct Furnaces AGA Approved For Downstream Use

AVAILABLE WITH

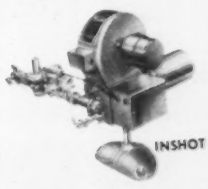
Dual Fuel	Adjustable Air By-pass
Modulation	High Velocity Nozzles
2 Stage Valve	High Pressure Regulator
Electric Ignition	115 or 24 Volt

GAS POWER BURNERS

Unconditionally Guaranteed



"V" SERIES



INSHOT SERIES

- 400,000 up to 8,000,000 Btu.
- No Combustion Chamber Required
- Saves $100 to $500 On Every Job
- 70,000 to 700,000 Btu.
- Simple Control System
- Easy to Service

POWER Hastings GAS BURNERS

ASK FOR BULLETIN H-10-GB

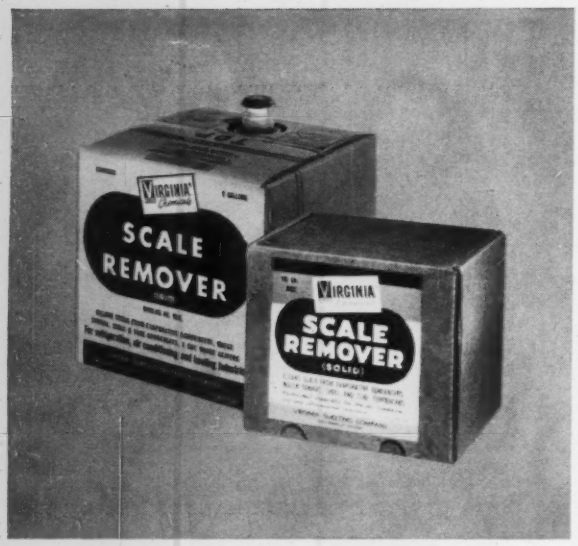
HASTINGS AIR CONTROL

Omaha 5, Nebr.

GAS FIRED Hastings UNIT HEATERS

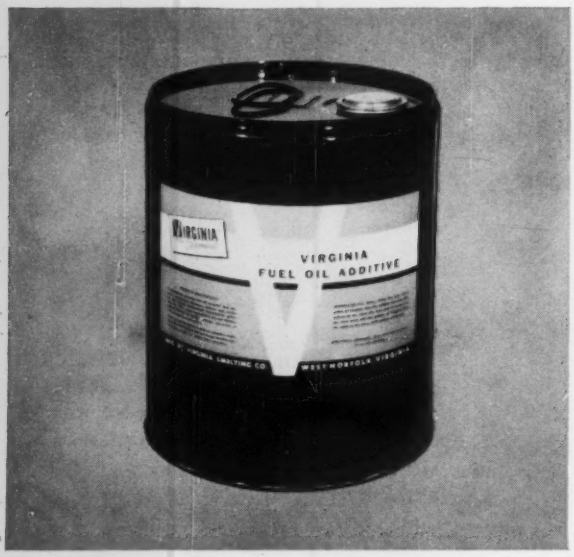
NOW, BIG BOILER TREATMENT

YOU PAY FOR THESE...



Liquid and Solid Scale Removers. The liquid is ideal for heavy scale removal, may be added directly to boiler. Inhibited to prevent metal damage, fast acting. The solid is preferred for live steam generators. Heavily inhibited. Nonvolatile. Liquid in 1 and 5-gal. plastic throw-aways, solid in 10 or 50-lb. packages.

Circulating Water Treatment. Halts corrosion, functions as an anti-oxidant, forms a protective film on metal surfaces in boiler and lines, keeps solids in suspension or liquid state. In 50-lb. drums containing 5 sealed 10-lb. plastic bags.

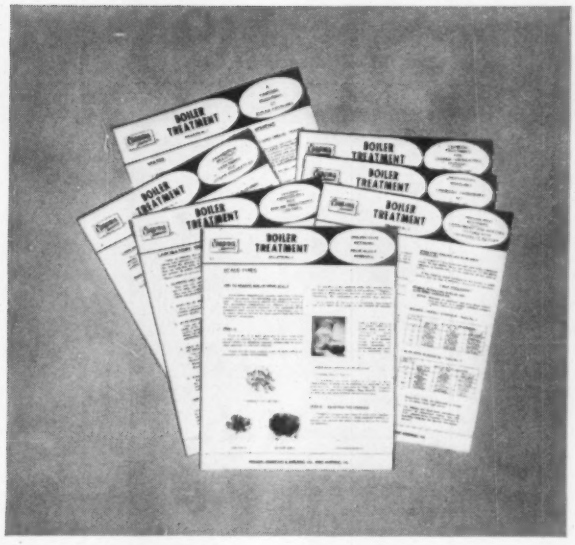


Fuel Oil Additive. A combustion catalyst combined with essential solvents and detergents to free tanks and lines from gum and sludges; promotes sootfree combustion; increases thermal efficiency up to 5%. In pint cans, 5, 28, and 53-gal. steel drums.

Boiler Protective Treatments. "Virginia" 2-Way Treatment for steam generators. Assists in production of steam free of carryover vapors, promotes smoother, quieter, more efficient boiling. "Virginia" 3-Way Treatment for condensate return boilers contains inhibiters that remain in boiler and volatile inhibiters that travel with steam and condensate. Both in 5, 28, and 53-gal. steel drums.

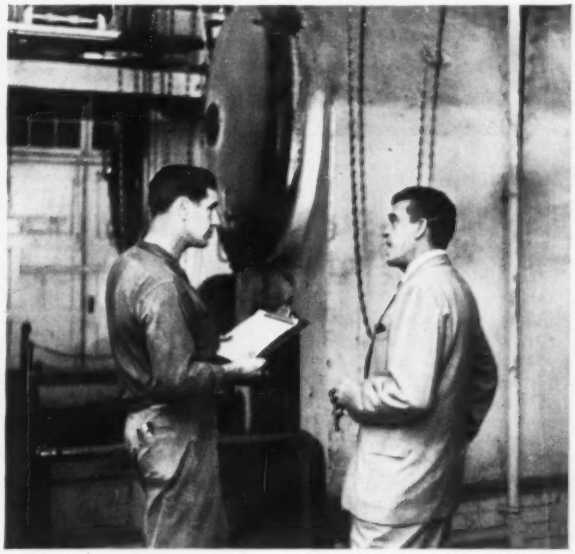
FOR SMALL BOILERS *(up to 300 psig)*

YOU GET THESE AT NO COST...



Technical Bulletins. Describing methods for treatment of steam condensate return systems; circulating hot water heating systems, live steam generators; chemical treatment of fuel oils.

Laboratory Services. A complete professional water treatment laboratory is at your service. Includes 30-day treatment checkup; water analysis; sludge analysis; special recommendations for unusual conditions.



Engineering Consultation. On-the-spot counsel from "Virginia's" water service engineers at your plant whenever a difficult problem arises.

For the first time, you get the same lab service, counsel and boiler protection available in the past only to large installations having their own professional staffs. The only cost to you is that of the chemicals needed, compounded by specialists to make your equipment work better and longer. This protection is yours at a cost so low you can't afford to be without it. Get the full details on the special "Virginia" plan for your installation. Send in the coupon today.

VIRGINIA Chemicals

Dept. B521
Refrigeration Division
Virginia Chemicals & Smelting Company
West Norfolk, Va.

Please send information on the special "Virginia" plan for chemical treatment of:

- ☐ Heating systems with condensate return
- ☐ Live steam generators
- ☐ Closed circulating hot or cold water systems
- ☐ Fuel oil treatment

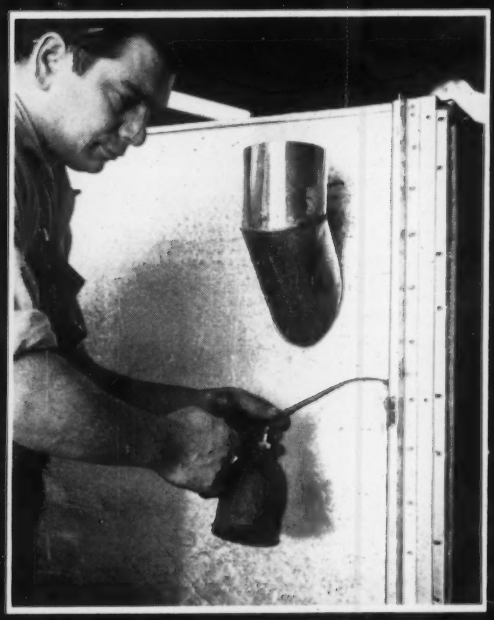
Name_____

Company_____

Street_____

City_____ Zone____ State____

ANOTHER
NEW 3M
CONSTRUCTION
PRODUCT!



ANNOUNCING: a competitively priced, high-performance sealer!

From the maker of duct sealers that safeguard some of the world's largest systems comes new 3M® Brand Duct Sealer Standard Grade. This new companion product of 3M Brand Duct Sealer 800 Premium Grade assures tough, flexible, trouble-free seals . . . meets critical established specification requirements . . . and at a competitive price.

3M Brand Duct Sealer Standard Grade resists both oil and water. Films of $\frac{1}{8}$" thickness remain flexible, even over a 1" mandrel at −20°F, and withstand continuous heat exposure as high as 200°F. This sealer may be applied by brush, caulking gun or pressure extruding equipment. Surfaces skin over in 5 to 10 minutes, become tack-free in an hour to avoid collecting dirt. 3M Brand Duct Sealer Standard Grade is recommended for both medium- and high-velocity systems.

For insulation, there are 3M Brand Adhesives for every bonding need. Included are a formulation that withstands heat up to 300°F, a non-flammable adhesive that eliminates fire hazards during application, and an economical high-coverage formulation for general use. In addition, 3M provides adhesive products for bonding ceramic, clay, vinyl and rubber tile, as well as wood, laminates and other materials . . . for sealing curtain wall, other external joints and surfaces. For data on the complete line of 3M construction adhesives, see Sweet's Catalog, your nearby distributor or write AC&S Division, 3M Company, Dept. SBHX-101, St. Paul 6, Minnesota.

MINNESOTA MINING & MANUFACTURING CO. 3M

Test this actual sample!

FLAME-BAR

New J-M pipe insulation vapor barrier jacket that **WON'T CARRY FIRE**!

3-PLY CONSTRUCTION. Outer ply of 35-lb. white bleached embossed kraft . . . bonded with flame-extinguishing adhesive to aluminum foil . . . reinforced with strong, inorganic fiber glass yarn on 1/6" centers in both directions.

MOISTURE PROTECTION. Flame-Bar has a water-vapor permeability rate of less than .02.

EASY MAINTENANCE. Washable surface doesn't discolor with age, but can be painted if desired. Stays wrinkle-free. Resists puncturing and tearing. No pinholes.

FIRE-SAFE. U. L. flame-spread rating of 25. Complies with National Board of Underwriters' Index 90A and 90B.

NEW FLAME-BAR JACKET IS NOW AVAILABLE ON ALL SIZES OF THESE J-M PIPE INSULATIONS TO GIVE CONTINUITY OF APPEARANCE ON A JOB.

MICRO-LOK
Fiber Glass

FIBROCEL®
Expanded Silica (rigid)

THERMOBESTOS®
Calcium Silicate (high temp.)

WRITE FOR FULL DETAILS:
Address J. B. Jobe, Vice-President, Johns-Manville, Box 14, New York 16. In Canada: Port Credit, Ont.

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Underwriters' Laboratories, Inc.
INSPECTED
SHEATHING MATERIALS
Not over 1,000 sq. ft. Issue No. 000
FIRE HAZARD CLASSIFICATION (Based on 100 for untreated Red Oak)
(Kraft exposed)
Flame Spread 25 Fuel Contributed 10 Smoke Developed 15
File No. R3783

MAKE THIS FIRE-SAFETY TEST!

Cut on dotted line. Hold lighted match to this surface. Then remove match. Note charring stops immediately when flame is removed.

43791—52/8/61

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For strength and ductility you can't beat

BETHCON GALVANIZED STEEL SHEETS

Bethcon galvanized sheets have a remarkable combination of strength and ductility that assures smooth shopwork and satisfied customers.

Bethcon sheets owe their superior qualities to Bethlehem's continuous annealing process which gives the base steel its strong-yet-workable characteristics.

Bethlehem's continuous galvanizing process bonds the zinc coating so tightly to the steel that you can put a Bethcon sheet through the toughest forming processes without cracking or flaking the coating.

Bethcon is available in a wide variety of gages, in coils or cut lengths, with either plain open-hearth or copper-bearing (Beth-Cu-Loy) steel for the base metal. If you want further information on Bethcon, your inquiry will get prompt attention from the nearest Bethlehem office.

Galvanized Steel

for Strength
... Economy
... Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Proven dependability for America's large commercial buildings

TACO HOT WATER HEATING

A rapidly increasing number of consulting engineers are discovering *more* reasons for specifying Taco products. They know that Taco's more than 40 years of experience in the heating and air-conditioning fields insures exacting standards of quality control, complete reliability of performance.

Nine Taco pumps are the heart of the hydronic heating system in Milwaukee's new American Bowling Congress Building. Only Taco "LP" pumps, used in this installation, enabled engineers to specify precisely the pump needed for a particular system — to "tailor" the pump to the job.

With total range efficiency engineered into every Taco pump, the consulting engineer is assured that he has specified the most economical unit obtainable. He has the added assurance that the pump will give years of trouble-free operation; at the lowest possible noise levels.

In Philadelphia, the recently completed Penn Center Cooperative Apartment Building installed nine Taco pumps for heating and four Taco heat exchangers for service water heating. In this installation, as well as in the ABC building, the efficiency engineered features of Taco equipment provide the total comfort required in

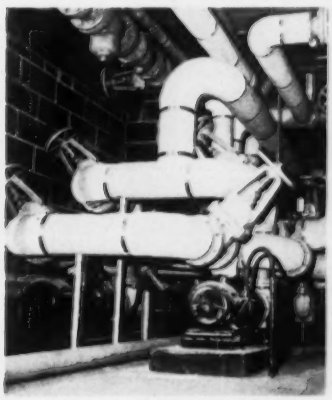
EQUIPMENT

today's modern buildings. Features such as self venting centerline discharge make installation and servicing economical and easy. Special alloy shaft sleeves and advance design mechanical seals assure long, dependable operation.

Regardless of what *your* needs may be in hydronic heating and cooling systems — whether you require standard or custom-built equipment — Taco can meet all of your specifications with significant cost-saving advantages.

See your local wholesaler, or write TACO HEATERS, INCORPORATED, 1160 Cranston Street, Cranston, Rhode Island.

Milwaukee's American Bowling Congress Building uses TACO "LP" Pumps exclusively for economical hydronic heating. Arthur Seidenschwartz, Jr., Engineer; Paul J. Gronav Co., Contractor.



Penn Center Cooperative Apartments in Philadelphia. This completely tenant-owned apartment building relies on TACO hydronic equipment for efficient heating and domestic hot water. George Idell, Architect; W. G. Flurer, Engineer; Mayson's, Inc., Contractor.

Taco

EFFICIENCY ENGINEERED PRODUCTS

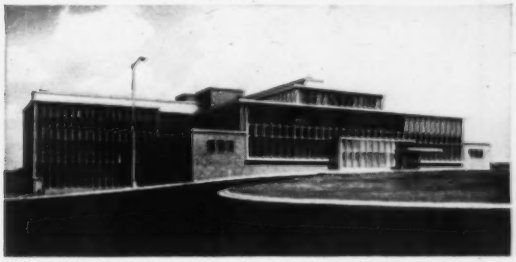
Architects and Engineers:
Fellheimer & Wagner, New York

General Contractor:
Southeastern Construction Co., Charlotte, N. C.

Mechanical Contractor:
B. & G. Olsen Co., Richmond, Va.

Engineering Building

Development Laboratory



Where Controlled Environment Counts, It's
JOHNSON PNEUMATIC CONTROL

... at Union Carbide Technical Center, for example

The new Union Carbide Technical Center in South Charleston, W. Va., is one of the most modern R&D facilities in industry today. It includes 12 buildings where over 1000 scientists and engineers carry out important assignments for Union Carbide Chemicals Company, Union Carbide Olefins Company, and Union Carbide Plastics Company.

A closely controlled thermal environment is especially important to the Center's operation, being essential to much of the experimental work as well as to the comfort and efficiency of the staff.

Specially engineered Johnson Pneumatic Control Systems help meet both types of demand with equal precision. Whether it's personal comfort in a private office, or special thermal conditions for individual projects in the Development Laboratory, the High Pressure Laboratory, or the Pilot Scale Laboratory buildings, Johnson Control maintains the exact air conditions required at all times.

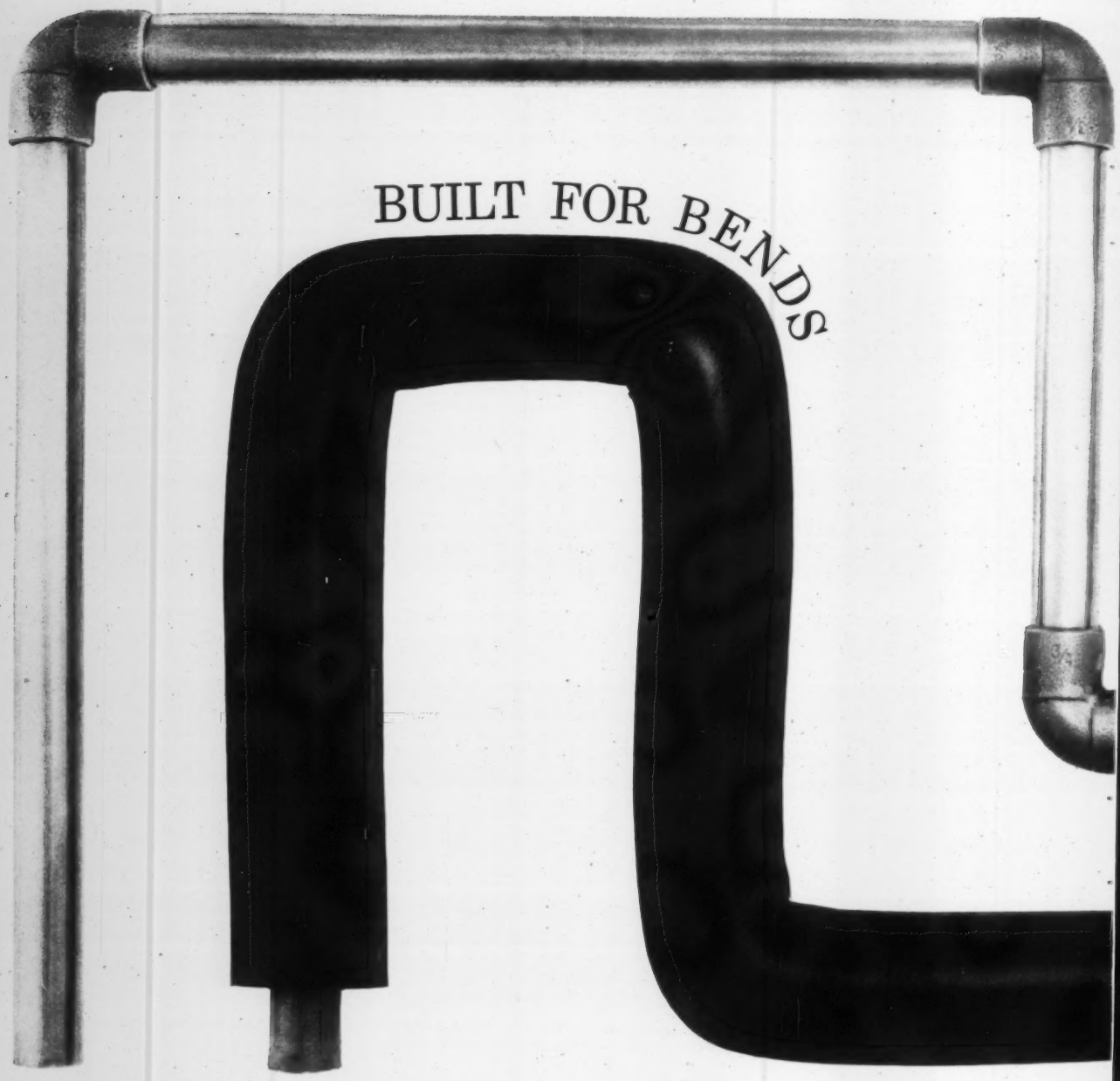
Johnson Pneumatic Control is applied to all types and makes of air conditioning, heating, and ventilating equipment, and to a wide range of industrial processes. Next time you have a problem of temperature, humidity, or pressure control, investigate the advantages you get from a Johnson System — in performance, dependability, and lifetime economy. Johnson Service Company, Milwaukee 1, Wisconsin. 110 Direct Branch Offices.

JOHNSON CONTROL

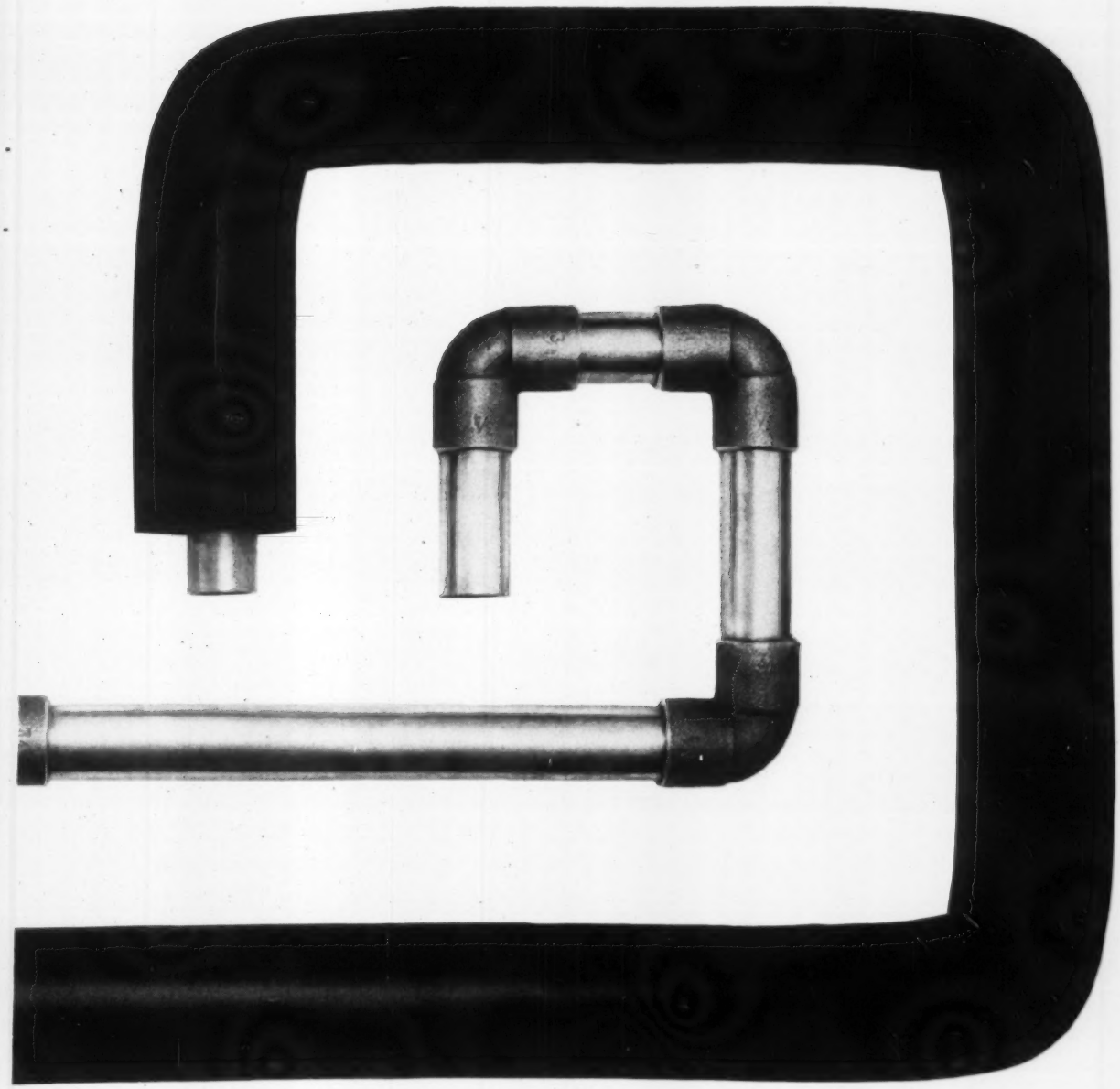
PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

A Johnson Pneumatic Control Center permits centralized supervision and control of air conditioning in the Engineering Building. Pneumatic indicators continuously display temperatures and pressures from all key control points. Remote adjustments may be made without leaving the panel. Selector switches place any system on either manual or completely automatic operation, as desired. In addition, local graphic panels, with temperature and pressure indication, are located in fan rooms adjacent to units. The system makes use of polyethylene tubing for compressed air piping.



J-M Aerotube...a flexible, anti-sweat insulation designed for quick installation on bent tubing!

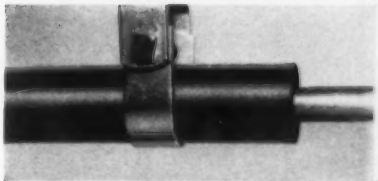


Now you can end the problem of pipe condensation on any indoor line quickly, easily and economically. With Johns-Manville Aerotube® even the most complex bend is a snap to insulate.

Aerotube is a flexible, foamed-plastic pipe insulation for use at temperatures from 32F to 220F. Its closed-cell structure prevents the passage of moisture under normal design conditions on indoor lines.

Because Aerotube is a flexible product (you can actually tie it in knots), it permits unique installation economies. The six-foot lengths go on quickly and easily. On new installations, simply slide Aerotube over tubing or pipes. For existing installations just slit Aerotube, snap it on and cement joints. That's all. Field reports show that installation costs can actually be cut in half.

If you have a condensation problem on heating, plumbing or air conditioning service lines, Aerotube can solve it. For full details, write to J. B. Jobe, Vice President, Johns-Manville, Box 14, New York 16, N.Y. In Canada: Port Credit, Ontario. Cable: Johnmanvil.



ALSO AVAILABLE...
A RIGID AEROTUBE

For compression-free insulation at pipe supports or for underground use, J-M's rigid Aerotube is recommended.

JOHNS-MANVILLE

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE

JOHNS-MANVILLE JM PRODUCTS

Oh Brother!!!!

For full information on these Low-Veloitcy Dual-Duct ATC Units, write for Carnes Catalog No. 1361.

. . . . to think I could have given my client Individual Zone Control for every office had I used

CARNES NEW LOW-VELOCITY DUAL-DUCT ATC UNITS

For the fastest relief of your zone control headache, take the perfect remedy that incorporates all the inherent advantages of dual-duct "pin-point" room control and low velocity. At the same time, slash your job cost, simplify ductwork, and increase operating efficiency.

For the closest room temperature control, coupled with the quickest response to changes in heating and cooling loads . . . specify Carnes new, completely packaged Low-Velocity Dual-Duct Acoustic Terminal Control (ATC) Units. Backed by quality controlled production techniques, accurately tested and rated for performance and sound power level, these units insure complete on-the-job satisfaction. On your next project, compare the many advantages of a low-velocity dual-duct system over other methods of air distribution.

Advantages over high-velocity dual-duct system

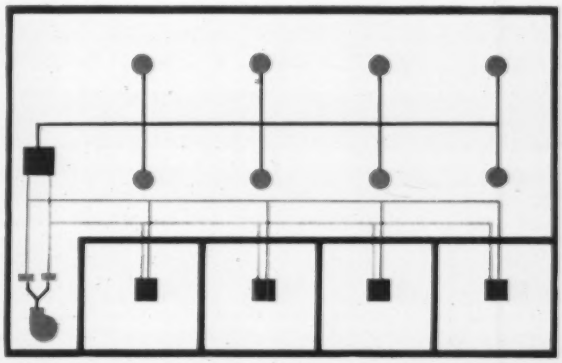
A less costly fan, smaller horsepower motor and reduced electrical power can force the same quantity of air through larger low-velocity ductwork, when space limits do not demand smaller high-velocity ducts. Less system noise reduces acoustical control components. Low-velocity cuts installation cost, ductwork need not be leakproof . . . slight leakage is often desirable, thus sealing and welding of seams and joints are eliminated. Fittings need not be so precisely made; lighter gauge material is approved. System static-pressure unbalance is controlled by conventional methods . . . . constant volume devices in each unit not required.

Advantages over multizone system

More zones are permitted by dual-duct system . . . hot and cold mains or branches can be tapped off to a terminal control unit at each specified space. Same amount of available ductwork space accommodates a greater number of zones.

Advantages over reheat system

Temperature of supply air — in a reheat system — must be maintained to satisfy the room with the greatest cooling load; reheat coils require year-round steam or hot water. In a low-velocity dual-duct system, the hot coils need not be operated during the cooling season — tempering is done by outside and recirculated air. Also, coils are centrally rather than separately located, cleaning and maintenance are thus simplified, and the dual-duct system can also respond more quickly to load change.



Private offices in this small office building are provided with individual low-velocity ATC units. The general office area is supplied by one large low-velocity ATC unit.

Carnes Offers A Complete Range of Models and Sizes

2 CEILING MODELS
End Discharge.....5 sizes
Bottom Discharge.....5 sizes

2 WINDOW PERIMETER MODELS
Top Discharge.....2 sizes
Front Discharge.....2 sizes

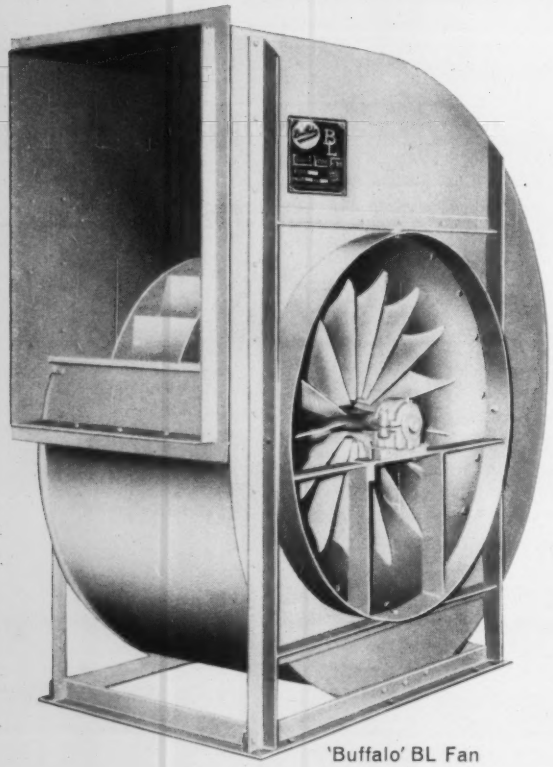
CARNES®

LEADERS GO TO CARNES FOR THE NEWEST IN AIR DISTRIBUTION

CARNES CORPORATION, VERONA, WISCONSIN / CANADIAN SUBSIDIARY: WEHR AIR EQUIPMENT COMPANY, LTD., 86 GERTIE STREET, WINNIPEG 2, CANADA.

QUALITY CONSTRUCTION? OF COURSE IT PAYS! Whether you sell it or buy it, there is no worthwhile substitute for quality construction. Where quality is high . . . performance and reliability are high. Where quality is sacrificed . . . maintenance and repair costs rise . . . customer satisfaction drops. For 84 years, Buffalo Forge has specialized in quality air and liquid handling equipment. It has paid off for the men who specify 'Buffalo'. Of equal importance, 'Buffalo' users are enjoying the true economies that only quality construction can produce.

the more critical the job . . . the more it pays to specify 'Buffalo'



'Buffalo' BL Fan

On critical jobs involving air and liquid handling, it is costly to compromise on equipment quality. Performance suffers. Downtime increases. Service life of the unit and working parts is shortened. Buffalo Forge engineering representatives, backed by a home office team of research and production engineers, will be glad to help you recommend and specify the *correct* equipment. Simply contact our representative in your area. Or, write to our home office direct.

THE WHEEL'S THE THING!

The 'Buffalo' BL Fan with its exclusive non-overloading backward-curved bladed wheel has earned a reputation for quiet, efficient, stable operation. This fan is being used to perfection on practically every conceivable job requiring Class I or II construction. Stationary inlet vanes are standard. Correct design permits use of optional variable inlet vanes rating. Design at inlet and outlet permits easy, air-tight connection of ductwork. Capacities range from 600 cfm to 500,000 cfm. For complete performance and construction details, write for Bulletin F-104.

"Buffalo"

AIR HANDLING DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

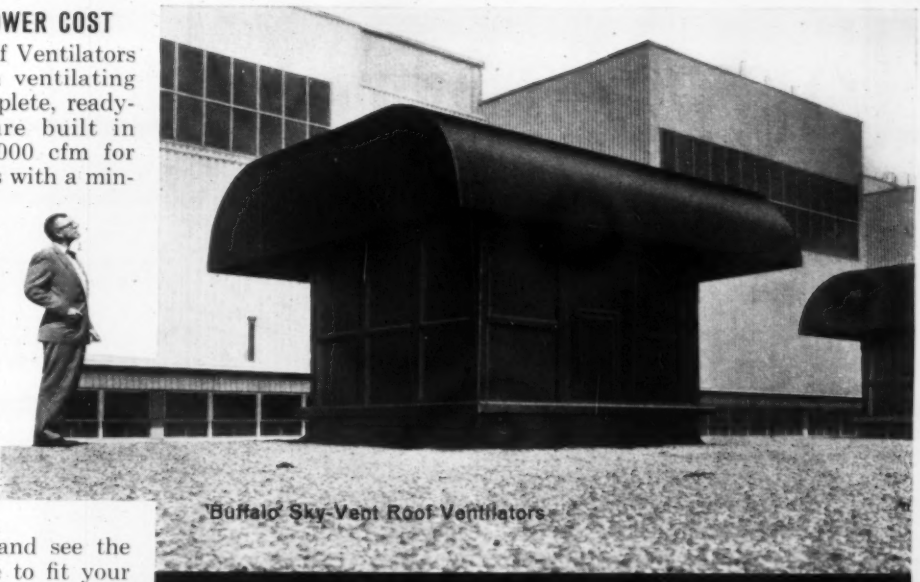
'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

HIGH CAPACITY FOR LOWER COST

'Buffalo' Sky-Vent Roof Ventilators offer many savings in ventilating large areas. These complete, ready-to-install packages are built in capacities up to 250,000 cfm for economical installations with a minimum of units. Thousands of these ruggedly built, weather-proof units are dependably exhausting fumes, mists, stale or overheated air from process and production areas . . . with no duct-work to alter when a plant layout is changed. Also built with filters and for heating coils as makeup air units. Write for Bulletin FM-2345 and see the wide selection available to fit your exact job requirements!



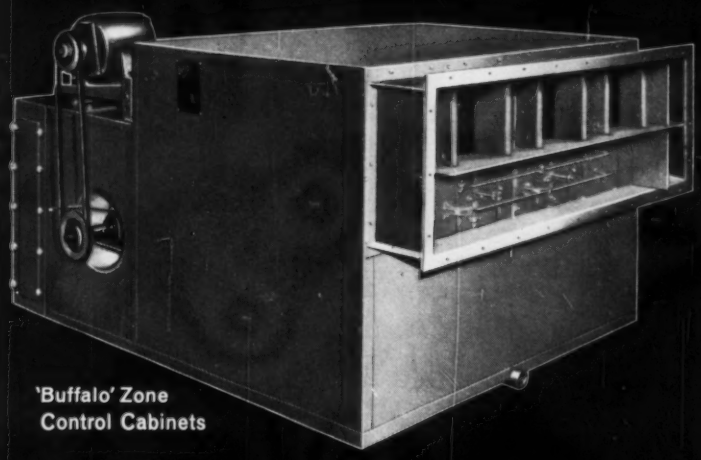
'Buffalo' Sky-Vent Roof Ventilators

ACCURATE MULTI-ZONE CONTROL

'Buffalo' Type PCB Zone Control Cabinets deliver the exact degree of comfort desired, zone by zone, through precise damper control. Dampers are heavy-gauge, with blades of die-formed shape for rigidity and tightness of fit. All zone openings are factory-sized for proper distribution.

Another exclusive feature is the 'Buffalo' mixed-flow type aluminum-wheel fan. Its steep pressure characteristic means minimum variation in capacity and power. Operation is fully stable, without pulsation or hunting. For ease of maintenance, fan bearings are outside lubricated.

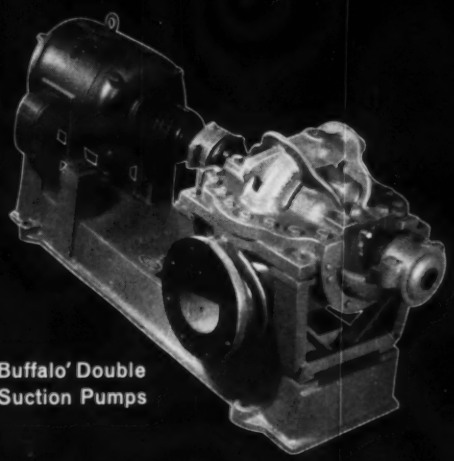
Here is a unit that is made-to-order for many of your office building jobs. Full details, including construction, dimensional and performance data, are in Bulletin AC-220. Write for your copy.



'Buffalo' Zone Control Cabinets

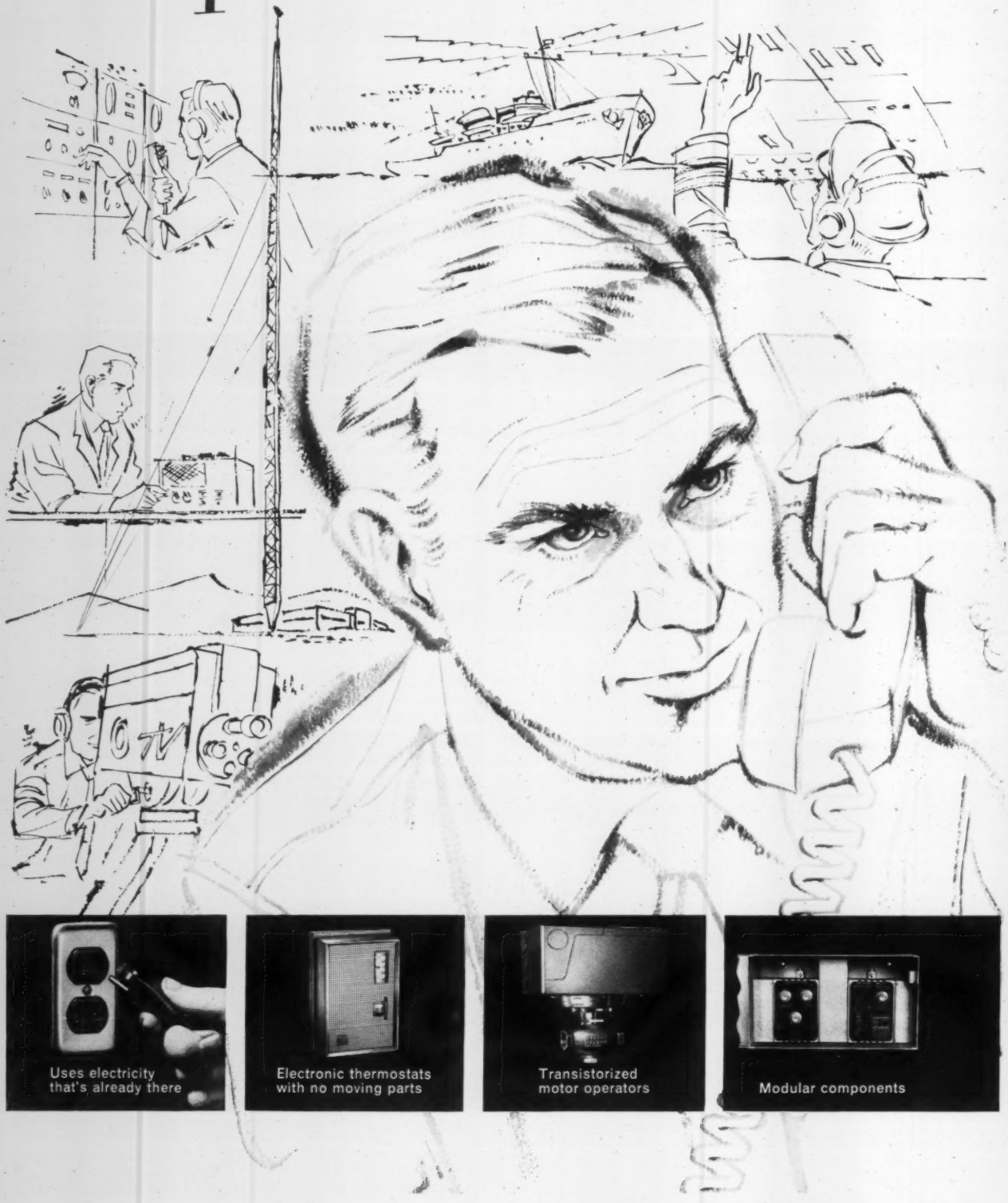
THE LATEST IN PUMPING EFFICIENCY!

'Buffalo' Double Suction Pumps have earned their reputation for smooth, efficient handling of clear water over many years. Now, the new-design 'Buffalo' Double Suction Pumps incorporate their best features plus many new ones . . . for the finest performances yet available. Suitable for working pressures up to 250 psi and temperatures up to 300° F., these new pumps are available in capacities from 20 to 14,000 gpm. Write for details on this and other new developments in efficient, dependable pumping by 'Buffalo'.



'Buffalo' Double Suction Pumps

Temperature Control



Uses electricity that's already there

Electronic thermostats with no moving parts

Transistorized motor operators

Modular components

is "Communications"

...only logical that it be electric-electronic!

Whenever you use or rely upon communication systems such as the telephone . . . intercom . . . dictating machine . . . or radio, reliable electric and electronic circuits are working for you.

Temperature control is a form of communications, too — whether a thermostat automatically corrects the position of a valve or damper, or a supervisor "reads" on a remote control panel the temperature in any area of a building.

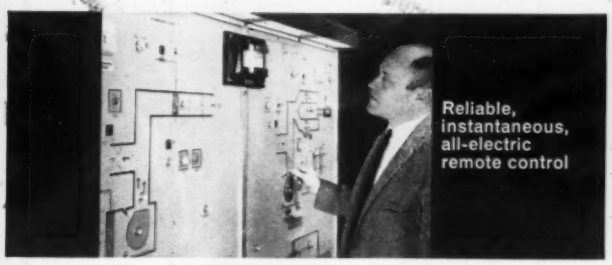
It makes every bit as much sense to use electricity and electronics for temperature control, as it does for other forms of communications — it is fast, accurate, and economical.

Barber-Colman "Electrionic" control systems actually are much less complex than most other electric-electronic communication systems you use; simpler than a radio, for example. This insures the utmost reliability and simplicity and ease of maintenance. Here are the key advantages:

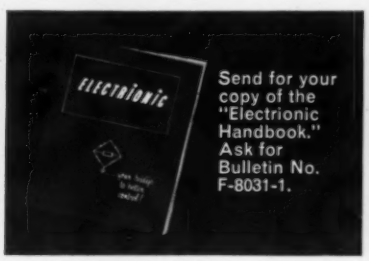
1. "Electrionic" control uses electricity which is already in the building.
2. There is a minimum of mechanical elements to cause maintenance problems.
3. There is nothing to go wrong with the wiring any more than there is for the wiring to the electric lights.
4. The reliability of all the components is comparable to that you experience with the finest commercial communications systems.
5. Maintenance is simple. Modular components are used throughout. Any electrical maintenance man can learn to quickly spot and correct any troubles.
6. Size of the building doesn't matter — in fact, the larger the building, the greater the benefits of the low maintenance and instantaneous operation of "Electrionic" systems.
7. System design assistance, installation, supervision, and service are provided by the nationwide Barber-Colman organization.
8. The finest that money can buy.

Any way you look at it, Barber-Colman "Electrionic" control systems are the logical, modern way to handle the temperature communications systems in any size or type of building.

Write today for literature and complete information.



Reliable, instantaneous, all-electric remote control



Send for your copy of the "Electrionic Handbook." Ask for Bulletin No. F-8031-1.

BARBER COLMAN

BARBER-COLMAN COMPANY

Dept. V, 1301 Rock Street, Rockford, Illinois

Factory Balanced – Ready to Use

NEW ANEMOSTAT

Mechanical Constant Volume Boxes, Type HV

Designed and developed for today's high velocity dual duct air conditioning systems, the Anemostat single motor HV mixing box is unexcelled for material, quality and performance. Pre-balanced and factory calibrated to operate consistently within ±5% of required air quantities, the Anemostat HV unit is ready for immediate operation upon installation.

The Anemostat HV mixing box requires **only one** pneumatic operator; the mechanical constant volume device* does the rest. This all metal device offers these unique design and construction features:

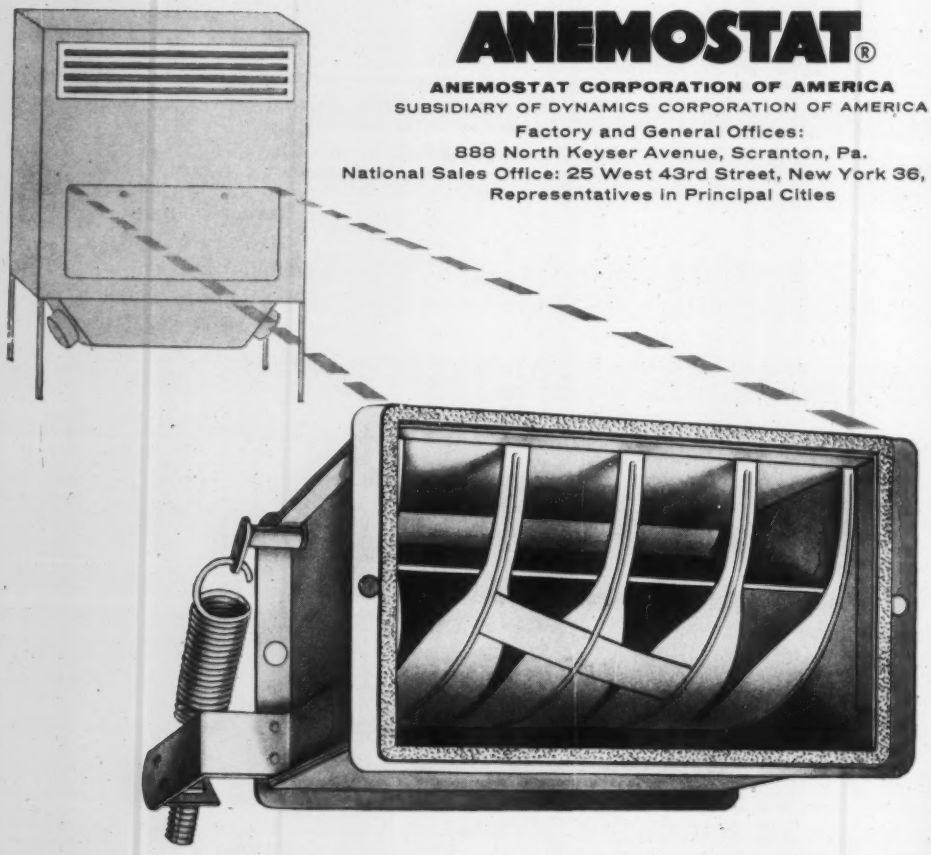
1 Built to last a life time, with corrosion-resistant parts, it requires no maintenance.

2 Allows for simple field adjustment to meet changing air requirements.

3 Operating engineers don't have to worry about replacing worn fabrics, nor is there any perforated metal to clog and impede efficiency.

The Anemostat HV mixing box is available for a wide range of air capacities. Write for Anemostat Bulletin Mech-70 today.

*Patent Applied For



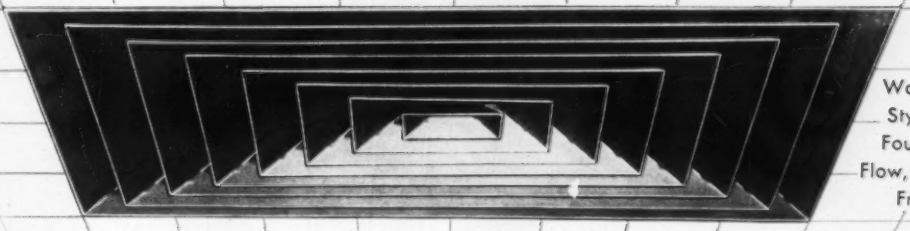
ANEMOSTAT®

ANEMOSTAT CORPORATION OF AMERICA
SUBSIDIARY OF DYNAMICS CORPORATION OF AMERICA
Factory and General Offices:
888 North Keyser Avenue, Scranton, Pa.
National Sales Office: 25 West 43rd Street, New York 36, N. Y.
Representatives in Principal Cities

AC1382

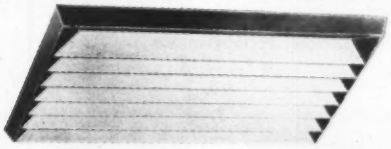
NOW! by Waterloo - Anemostat

THE FIRST ALL EXTRUDED ALUMINUM TYPE D DIRECTIONAL DIFFUSER

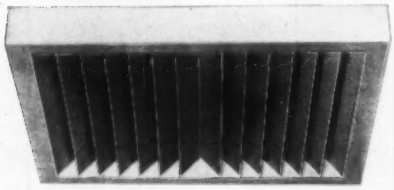


Waterloo Style DE Four Way Flow, Snap-in Frame

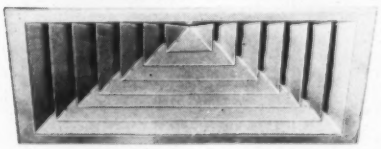
SQUARE and RECTANGULAR DESIGNS



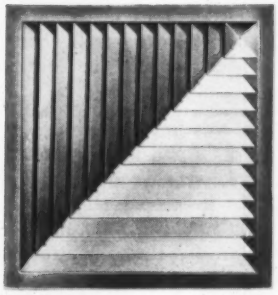
Waterloo Style DM One Way Flow Bevelled Frame



Waterloo Style DD Two Way Opposite Flow Drop Collar Frame



Waterloo Style DF Three Way Flow Flange Frame



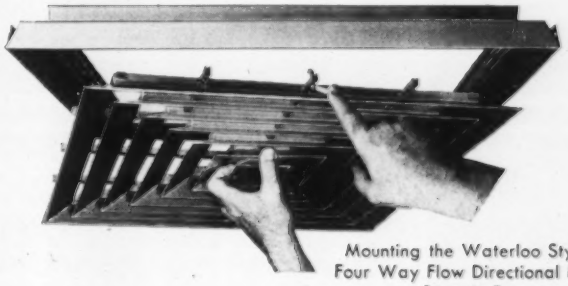
Waterloo Style DL Two Way Corner Flow Lay-on Frame

★ **EASIEST TO INSTALL**

★ **ONE-THIRD THE USUAL WEIGHT**
because of aluminum construction

★ **LONG-LASTING**
All extruded aluminum

★ **5 FRAME STYLES • 14 CORE PATTERNS**
All cores removable and interchangeable



Mounting the Waterloo Style DE Four Way Flow Directional Diffuser Snap-in Frame

DESIGNED BY WATERLOO
... pioneer in development of air diffusion equipment in EXTRUDED ALUMINUM

PERFORMANCE PROVED BY ANEMOSTAT
in the finest laboratories in the air conditioning industry

CATALOG 7-61 AVAILABLE ON REQUEST.

WATERLOO *Air Diffusion* EQUIPMENT

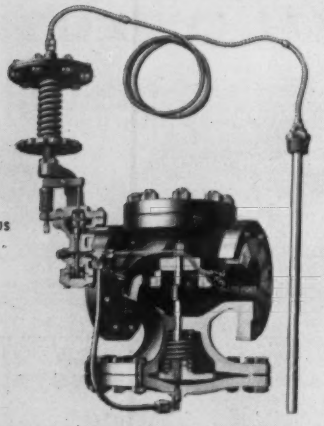
WATERLOO REGISTER COMPANY, INC.

P. O. BOX 147, WATERLOO, IOWA

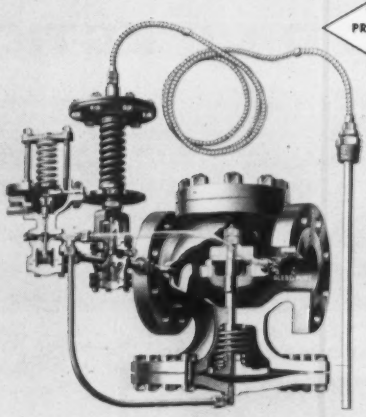
WR-124

How to Select Automatic Regulating Valves For Temperature Control

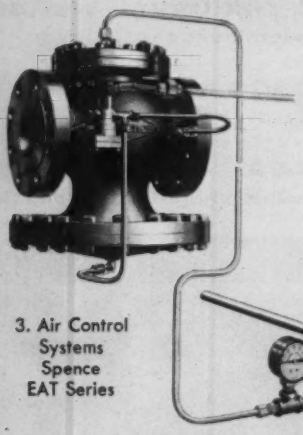
THE MOST COMPLETE LINE OF PRESSURE AND TEMPERATURE REGULATORS IN THE WORLD



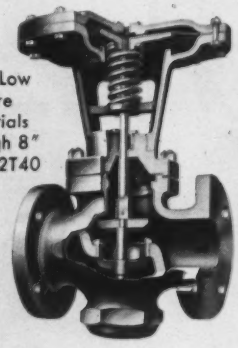
1. Instantaneous Heaters Spence ET124 Series



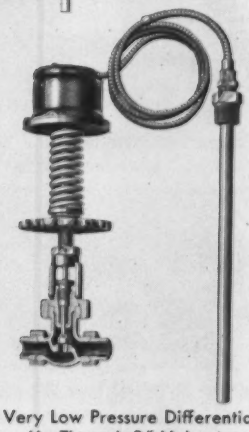
2. Storage Heaters Spence ET14D



3. Air Control Systems Spence EAT Series



4. Very Low Pressure Differentials 2″ Through 8″ Spence G2T40



5. Very Low Pressure Differentials Up Through 2″ Valves Spence Direct Acting T2

During the past year, our field representatives have reported many cases of improperly, and uneconomically, applied temperature regulators. To help you avoid some of these costly mistakes, here are a few tips on selecting the most effective and economical temperature regulating valves for your applications.

1. Instantaneous heaters require a special action for close temperature control and freedom from hunting. In the Spence ET124 series, steam pressure is modulated according to temperature (demand) and is automatically regulated at any pressure established by the demand.
2. Storage heaters, on the other hand, are more economically controlled by the Spence ET14D, which includes a simple temperature-actuated pilot that opens and closes the main valve to maintain a constant temperature.
3. Air control systems can now have a ±5°F control accuracy under wide and instantaneous load swings with the Spence EAT regulator. Engineers report savings of up to 50% in installed costs with this recently developed Spence cascade system when it has been used in place of conventional instrumentation.
4. For the combination of very low pressure differentials and air or water control, Spence recommends Type G2T40. This single seated valve provides fast, positive response in 2″ through 8″ valves. Double seat Type G22 is also available for 10″ through 12″
5. When very low pressure differential is encountered with valves of 2″ or less, the Spence direct operated T2 is recommended. The sensitive vapor tension thermostat responds quickly to small changes in bulb temperature for continuous, accurate control.

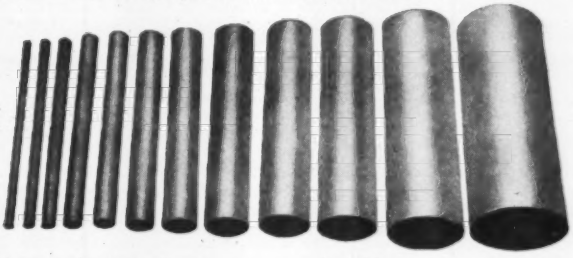
In this brief description of industrial process and heating temperature control, we have given a few important tips in proper regulator selection. If you would like more detailed information on these control applications, write for the new Spence Temperature Control Bulletin IV 1014. SE-150

SPENCE ENGINEERING COMPANY, INC.
Walden 1, N. Y.
Paulsen Spence, P. E., President

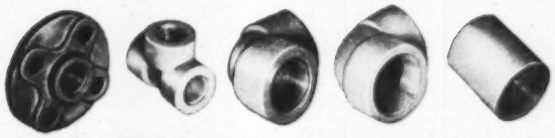
Van-Cor® THE ANSWER TO CORROSION PROBLEMS

WHAT IS VAN-COR? Van-Cor is rigid unplasticized polyvinyl chloride. Available in two types: Van-Cor 1—*Normal Impact* and Van-Cor 2—*High Impact.*

ADVANTAGES OF VAN-COR—Van-Cor is highly resistant to corrosion by hundreds of industrial acids and alkalies. Van-Cor is light in weight (½ that of aluminum). Van-Cor has high tensile strength and low flow resistance. Van-Cor is easily installed because it can be formed, machined, threaded and welded.



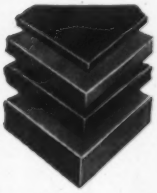
VAN-COR PIPE—Diameter sizes from ¼" thru 12". Available in 10 ft. or 20 ft. lengths.



VAN-COR FITTINGS—Sizes from ¼" thru 12". Includes: threaded fittings, socket fittings, flanged fittings, belled fittings and special fittings.

VAN-COR VALVES

Sizes from ½" thru 3". Types include diaphragm valves, plug valves, lift check valves, ball check valves, ball valves, and Walworth "Y" globe valves.



VAN-COR SHEETS

Thicknesses range from 1/32" thru 2". Sheet stock size is 48" x 96". Transparent on special order.

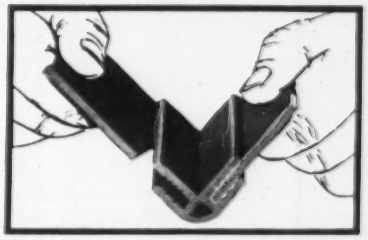
VAN-COR EXTRUDED 90° ANGLES

Sizes: 1½" x 1½" x 1/16" and 2" x 2" x ¼". 10 ft. lengths.

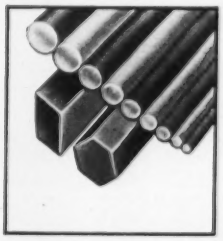
* * * *

TUFTITE® PVC pipe is unaffected by sewage or harmful soil conditions. Will not break in storage, installation or use. Roots cannot penetrate Tuftite's bonded joints. Lightweight; easily installed. Tuftite is available Plain or Perforated, 2" thru 6" diam., 10' or 20' lengths. Tuftite fittings are also available.

VAN-COR JOINING STRIPS

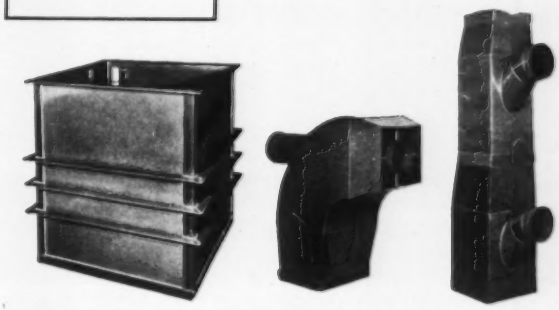


For connecting PVC stock by solvent welding. 90° joining strips for corners, H strips for a single plane. For sheet gauges of 1/8", 3/16", ¼". 10 ft. lengths.



VAN-COR BAR STOCK

Round bars, ¼" thru 2" diam. in 10 ft. lengths. 2½" thru 4" in 5 ft. lengths. Hexagonal bars, 7/16" thru 2" in 10 ft. lengths.



VAN-COR CUSTOM FABRICATIONS

Colonial will fabricate to your specifications hoods, tanks, ducts, tank linings, etc.

OTHER FORMS—Van-Cor is also available in Welding Rods, Bolts and Nuts, Extruded Seamless Duct, Fabricated Duct, and Custom Extrusions.

VAN-COR CATALOG

Request complete catalog containing detailed specifications, diagrams, flow charts, chemical resistance tables and installation data.

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Honeywell's simplified construction protects critical working parts in the base. A low-mass sensing element provides immediate response to temperature changes. The heavy gauge steel cover stands up to the toughest abuse. Seven finishes are electro-plated for lasting beauty—highly impervious to scratches and smudging. Two finishes are tough, baked-on enamel.

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Install Honeywell controls to assure your customers of the finest, smoothest heating and cooling.

Be sure you tear out the color chart on the next page to help you sell your prospects. For assistance on your next job, contact the Honeywell representative in your territory. *Sales and service offices in all principal cities of the world.*

TEAR OFF AND SAVE!

LOOK AT ALL THE FINISHES YOU CAN OFFER!

SATIN CHROME. A brushed chromium plated surface. This finish supplied if no other specified.

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POLISHED CHROME. A bright chromium-plated surface, ideal for hospitals and other institutions.

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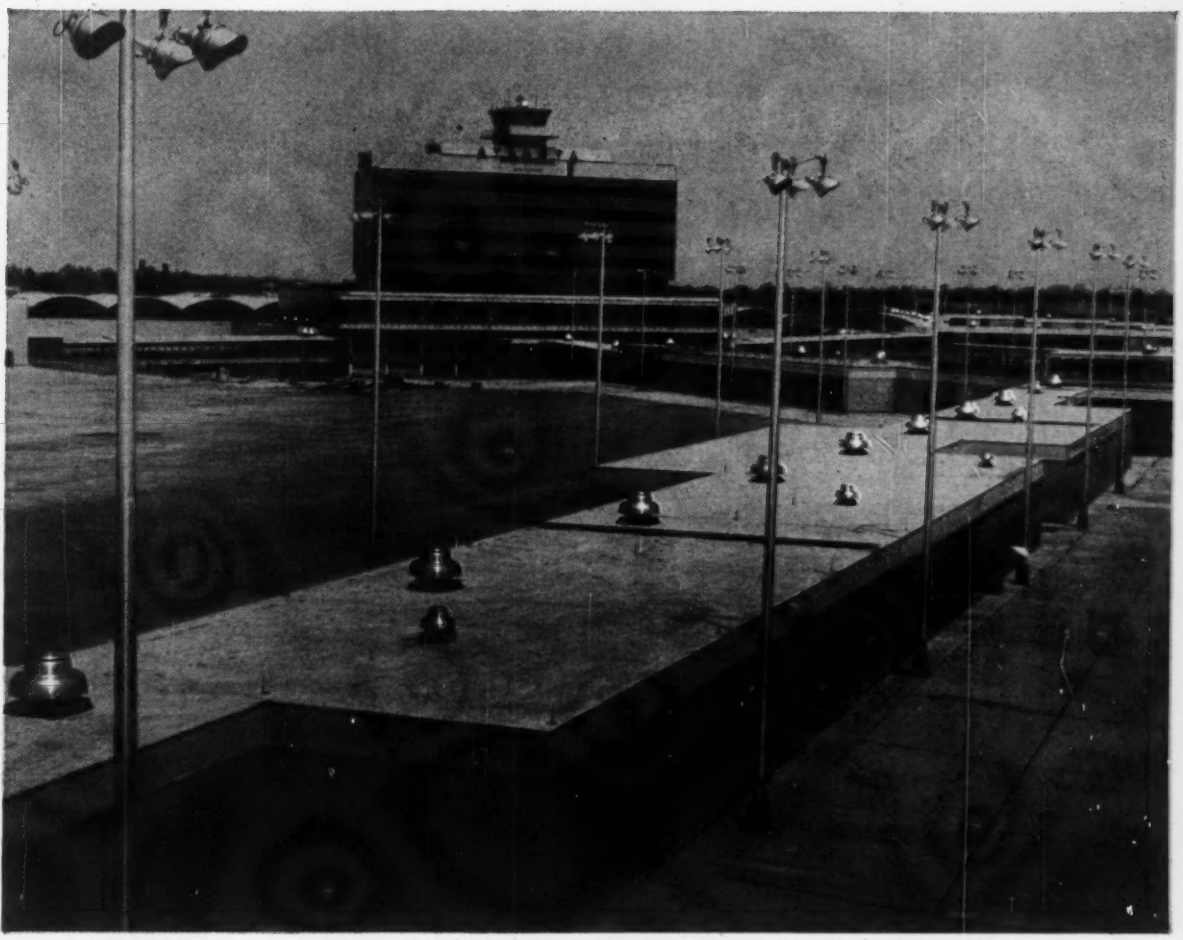

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JENN-AIR POWER ROOF EXHAUSTERS

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Some of the advantageous features of Jenn-Air units:

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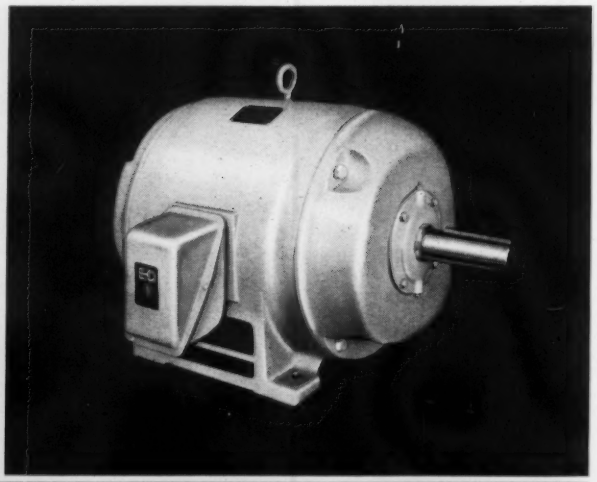

Motor Frame Size	NEMA Standard Balance*	Electro Dynamic (1) Standard Balance*
182 — 256U	.0010 inches	.0005 inches
284U — 326U	.0015 inches	.00075 inches
364U — 405U	.0020 inches	.0010 inches
444U — 507W	.0020 inches	.0010 inches
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Electro Dynamic has done something about eliminating motor caused noise in heating, ventilating and air conditioning systems.

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Maintain high pump efficiency, minimize recirculation past the impeller rim; rings easily replaced when waterborne particles cause wear.

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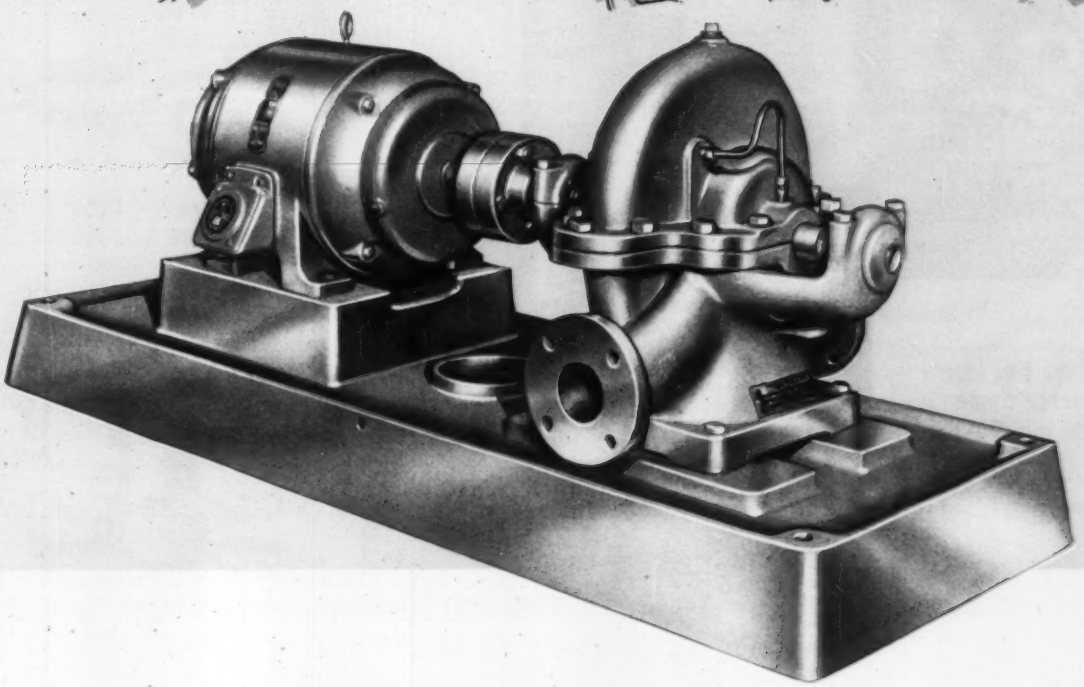

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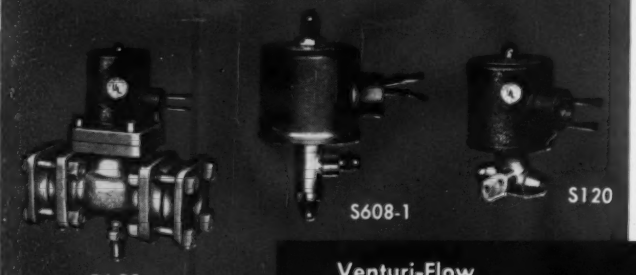

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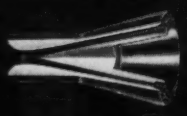

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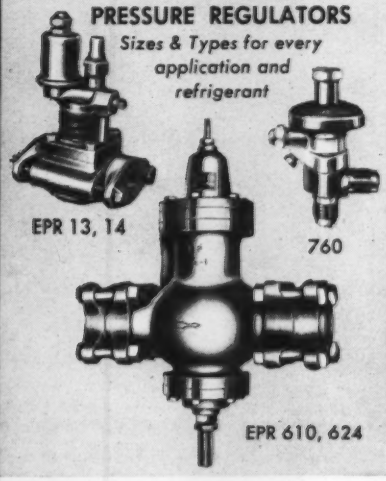

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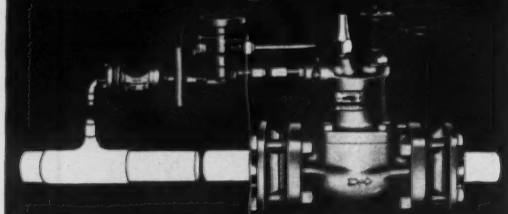

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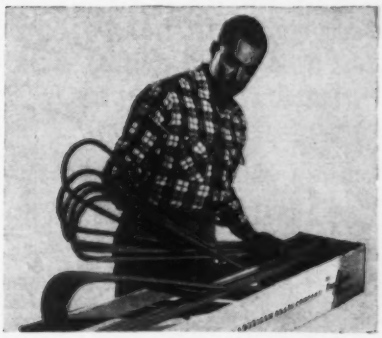

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Exclusive Flutter-Jet washing system forces water all the way through to wash away dirt automatically . . . eliminates breakdowns . . . makes a cleaner virtually trouble-free

Efficient washing is the key to efficient air cleaning. But up until recently, nobody was able to come up with a positive, trouble-free washing system.

Now Honeywell engineers have licked this problem once and for all.

Honeywell's exclusive Flutter-Jet washing system does the job thoroughly and automatically. Gone are the problems of breakdown, poor efficiency and high maintenance that have plagued air-cleaning systems in the past.

Removes dirt with a blast of water

A powerful jet-stream of water shoots out of a flexible hose which whips up and down at a rapid rate. This throws thousands of jets of water in, on and through the collection plates. The manifold, moving back and forth, sweeps the area completely, washing every corner.

JETS PENETRATE WHERE SPRAY CAN'T

Mounted on moving manifold, Honeywell Flutter-Jets whip up and down. Blast jets of water all the way through dirty air cleaner plates. Ordinary nozzles tend to fog. Their thin spray fans out. Can't penetrate or clean as jet-streams do.

Honeywell's Flutter-Jet washing system includes five cycles of Jet washing. A final spraying of adhesive can also be supplied when necessary to allow the dirt to be washed off more easily in the next wash.

Unlike other washing systems with spray-type nozzles, Flutter-Jet cannot fog the water or clog, which reduces cleaning power and adds to maintenance.

Already in operation for well over a year in many buildings, the trouble-free operation of Honeywell's electronic air cleaner with Flutter-Jet washing is a matter of record (available just by writing for it).

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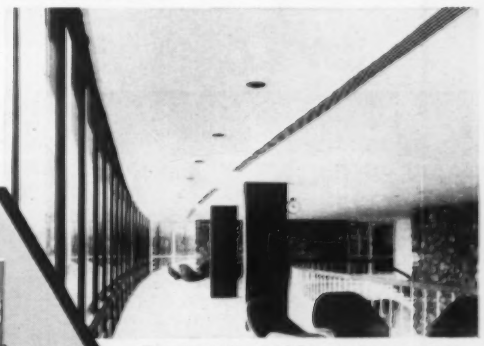

The fluent lines of Connor linear ceiling diffusers accentuate and complement the rich simplicity of the building's interior and provide highly effective air distribution.

In this extremely impressive new I.B.M. building, one assurance of an always suitable climatic interior is a reliable air distribution system made up from Connor's complete line.

5,360 different Connor units contribute "constant comfort conditions" for I.B.M.'s employees and visitors.

"C-ing" it from the top, the increasingly popular all air system includes Pneumavalve, the exclusive Connor element that's at the heart of the Kno-Draft Series 45P mixing boxes, 350 of which are installed here; 450 sleek linear diffusers; 1200 perforated supply and return diffusers; 130 circular supply diffusers; and 3,230 specially designed snap-in type supply, return, and exhaust registers and grilles. The diffusers, registers, and grilles were supplied in a special color to blend with the interior design and color schemes.

The Connor All Air System—of which Pneumavalve is the indispensable part—offers many advantages of design, function, and economy. Write for information on the complete system or any individual unit. Representatives in principal cities.

In the building's striking auditorium, circular Connor ceiling diffusers are neatly recessed in the same cone-like pockets that hold the overhead lights, another example of how the diffuser adapts to design features yet distributes air in an ideal pattern.

CONNOR... for Constant Comfort Conditions

CONNOR kno·draft® AIR DIFFUSERS

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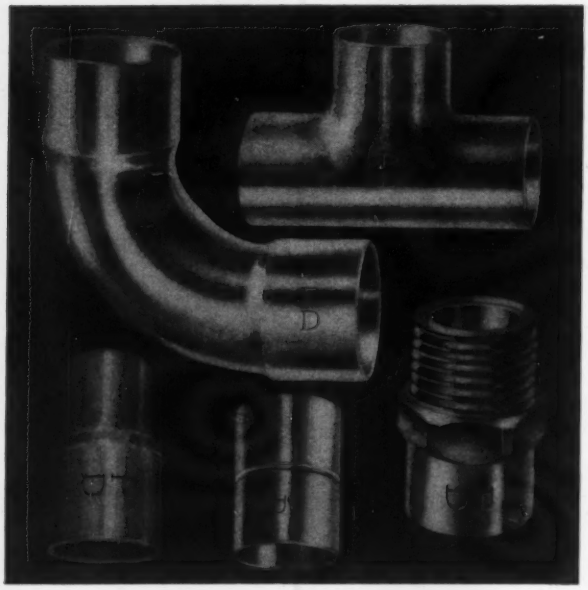

1 NEW WROT SOLDER-TYPE FITTINGS. Phelps Dodge has added a wide range of fittings in sizes from ⅛-inch to 6 inches. All fittings are protectively packaged for factory-clean delivery.

2 COLOR-CODED ACR TUBE WITH O.D. MARKINGS. Phelps Dodge ACR tube is specially cleaned for refrigeration use. Extra-long coded end caps are your assurance of factory-clean tube at job site. Tube is color-coded for fast identification and marked with outside dimension.

3 NEW P-D PAK CARTON. Reel-type design of convenient new carton allows refrigeration tube to be rolled or paid out quickly on the job. Color-coded tape seals carton for protection, yet opens easily.

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GRADUATED

LOCK AND SHIELD

ANGLE PATTERN

GLOBE PATTERN

CORNER PATTERN (Sectional Below)

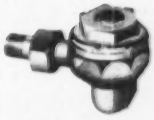
MARSH THERMOSTATIC RADIATOR TRAPS

ANGLE PATTERN

STRAIGHTWAY PATTERN

VERTICAL PATTERN

LEFT HAND CORNER PATTERN



RIGHT HAND CORNER PATTERN

CUT OPEN VALVE

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No. 5 VENT, ONE OF MANY

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No. 500 INVERTED BUCKET TRAP

All the best of their kind!

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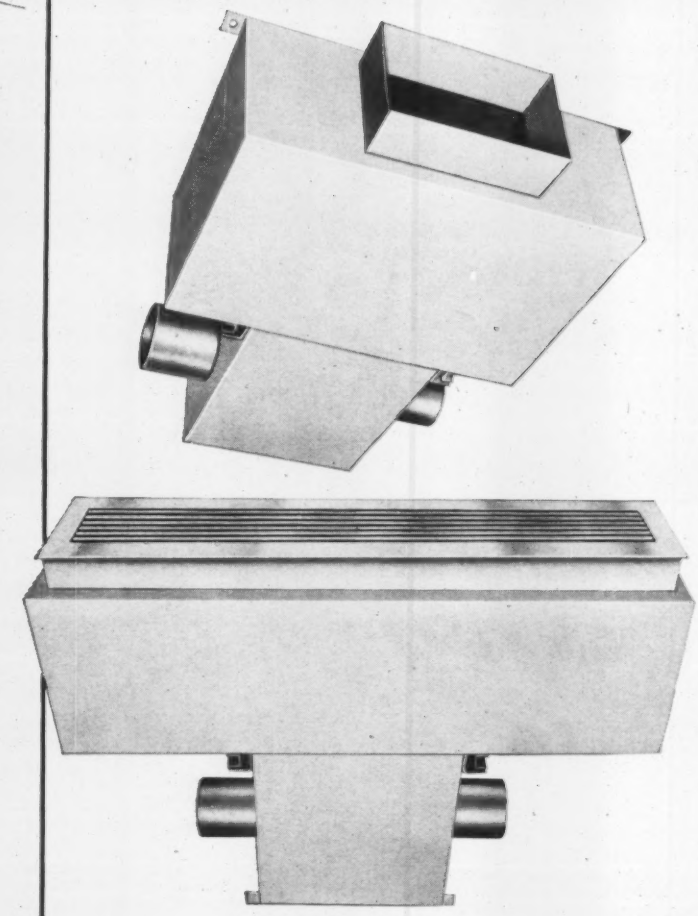
CONSTANT VOLUME MIXING BOXES

When AGITAIR high velocity mixing boxes are installed, you can be sure that required indoor climate conditions are constantly maintained regardless of sudden changes in outdoor temperatures.

These units designed and developed by Air Devices Inc. engineers, incorporate every desirable element necessary to assure perfect air mixing—constant air volume control—noise attenuation and air distribution.

One motor operates inlet valves—AGITROL volume regulator guarantees constant volume control within five percent of design—extremely low sound ratings. For noiseless, draftless distribution of the conditioned air from these AGITAIR units there is a complete line of AGITAIR genuine diffusers and grilles that can be employed to meet any job requirement.

Technical Catalog HV-100 contains complete performance data and dimensions on all AGITAIR mixing boxes. Write for your copy today.



featuring... One motor—no linkages. Aluminum inlet valves driven directly—instantaneous response...no lost motion...no backlash. Unique AGITROL valve (constant volume regulator) actuated solely by the supply air. Both mixing and attenuation chambers fabricated of galvanized or galvannealed steel...sealed to prevent air leakage. Split fabrication of attenuation chamber permits dimension adaptation to meet most space limitations.

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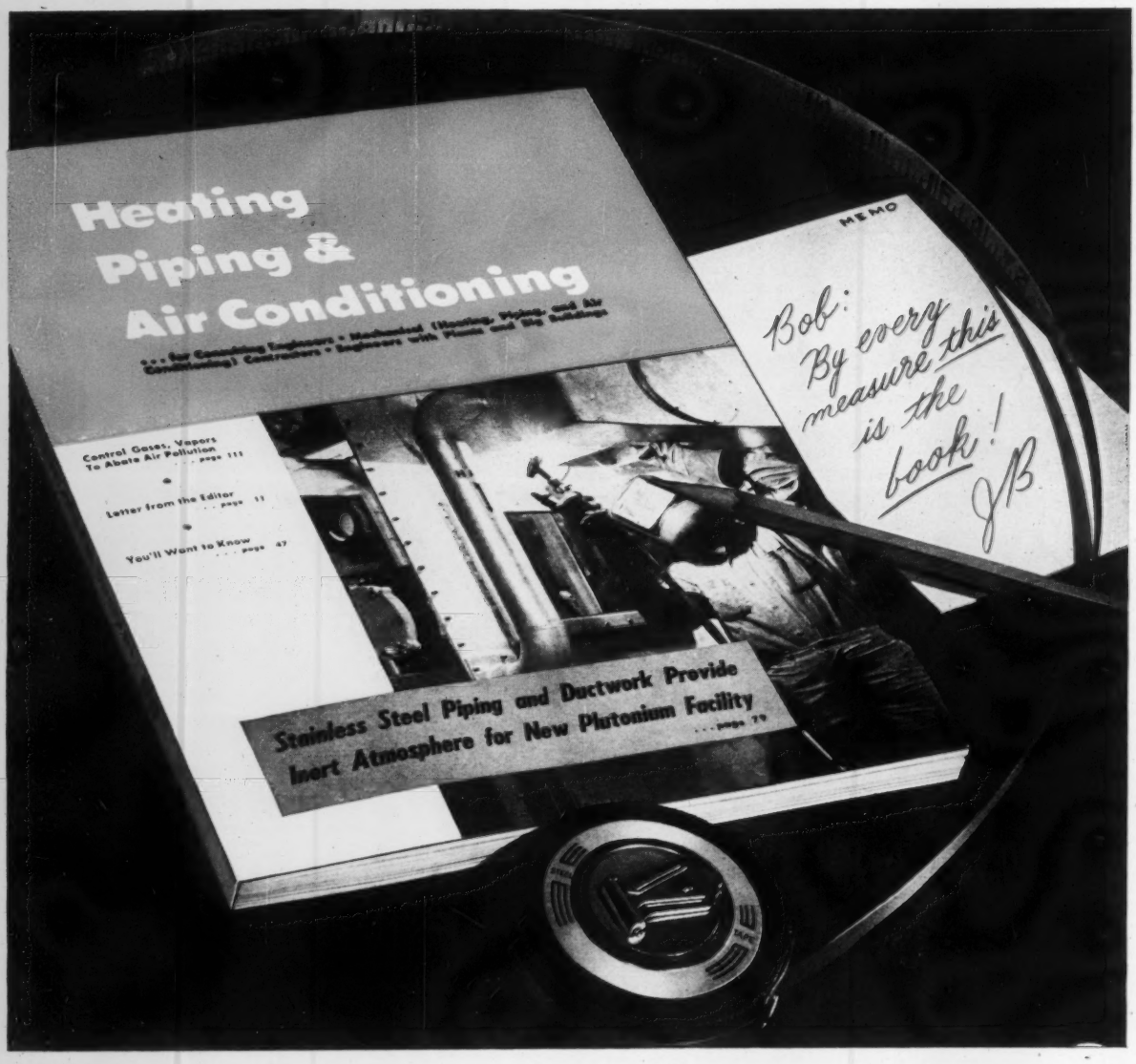

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How Much Steam Should a Steam Trap Trap?

. . . some answers to commonly asked questions about the primary job of a steam trap

You don't need a doctor's degree in thermodynamics to answer the question at the top of this page. Naturally, a steam trap should trap *all* the steam.

Unfortunately for you, the problem isn't quite that simple. After all, a shut off valve would trap all the steam . . . and condensate, and air, and carbon dioxide as well.

So we'd better amend the answer to the question this way: A steam trap should trap *all* the steam but *must* remove condensate, air and carbon dioxide as rapidly as they accumulate.

With this established, let's take a closer look at what's involved:

A Steam Trap Should Trap All The Steam

If you've had experience with several different makes of traps, you already know that some trap steam better than others. The operating principle of the trap is what makes the difference. We like to talk about it because Armstrong traps are designed so that no steam can get to the orifice. The valve is always water sealed. Result: *More efficient steam utilization, lower fuel costs.*

A Steam Trap Should Remove Condensate

All traps remove condensate—after a fashion. For maximum efficiency in the unit being drained, though, the trick is to get it out without waiting for it to cool and without leaking steam.

Armstrong's water sealed valve takes care of steam leakage. The inverted bucket operating principle opens the trap for water regardless of its temperature. This means you get the condensate out as quickly as it accumulates. Result: *Higher temperatures and better heat transfer in steam heated units.*

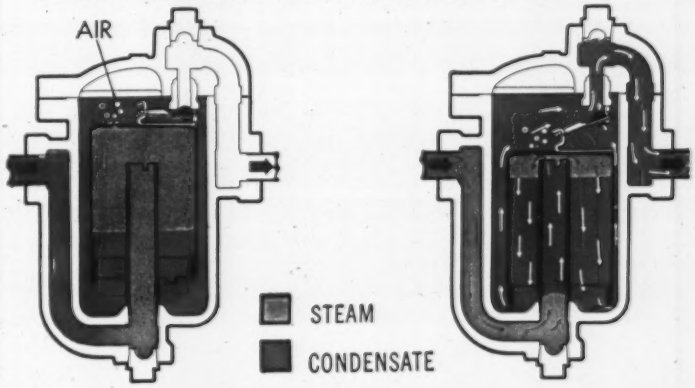
A Steam Trap Should Remove Air and CO_2

Part and parcel of the condensate removal problem is removal of air as well as oxygen and carbon dioxide—two real troublemakers. Air tends to reduce operating temperatures and interfere with heat transfer. CO_2 goes into solution to form corrosive carbonic acid which, for example, can eat unit heater tubes. O_2 aggravates the situation. Believe it or not, but all traps don't properly remove air and CO_2.

By now, you've probably guessed that Armstrong traps *do* remove air and CO_2. Armstrong design (see illustration) provides continuous venting of air and CO_2. By opening suddenly, the Armstrong trap creates a momentary pressure drop to "pump" the air down to be vented. Result: *Higher temperatures, faster heat-up, better heat transfer and reduced corrosion.*

Note: When required, specially sized air vents are furnished. For fast heat-up of low pressure on-and-off units, Armstrong provides open float and thermostatic air vent traps.

HERE'S THE STEAM TRAP DESIGN THAT GETS RID OF CONDENSATE AND AIR WITHOUT STEAM LOSS



Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

What's the Final Answer?

Summing it all up, you'll get the best service from steam heated units that are equipped with traps designed to trap *all* the steam and remove air and condensate as quickly as it accumulates. In our prejudiced viewpoint, this means Armstrong traps. More important are the several thousand users of Armstrong traps who have proved the point.

Before you make up your mind, though, consider the minimum maintenance requirements of Armstrong traps . . . and the convenient assistance your local Armstrong Representative provides. These are important plus values.

Put Up or Shut Up

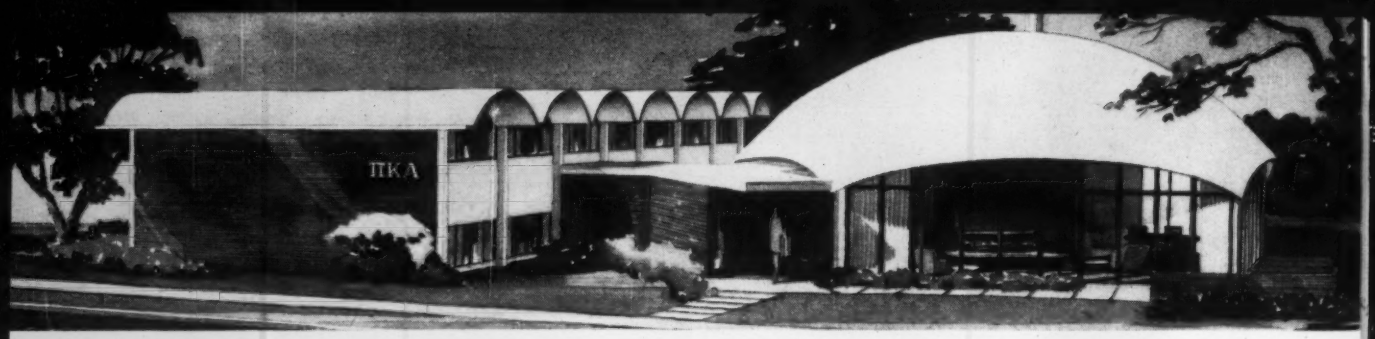
We're so confident that we "put up". Armstrong traps are unconditionally guaranteed to satisfy. So you can find out for yourself with practically no risk. If you're not completely satisfied with the way they do their job, you can get your money back.

• • •

The 44-page Armstrong Steam Trap book goes into greater detail on these and other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write

Armstrong Machine Works
8743 Maple Street
Three Rivers, Michigan

ARMSTRONG STEAM TRAPS



This free-span dome, housing the fraternity chapter rooms and recreational facilities, has glass walls which have a greater heat loss than solid walls. Radiant heating was chosen since it heats uniformly and holds temperatures for longer periods of time.

SPANGRID Steel Pipe radiant heating system serves Denver's first Geodesic Dome structure

The Geodesic Dome is a new architectural form, and the Pi Kappa Alpha Fraternity House at the University of Denver is one of the first of this type in the United States.

SPANGRID uniformity helps speed installation

Over 4,000 ft. of SPANGRID Steel Pipe was fabricated for the radiant heating system on the job by two men in less than 60 hours. Pipe was bent on a hydraulic bender with no damage to pipe, weld or finish. The 21-ft. sections were easily welded into the grid and the system was subjected to a 100 psi hydraulic test for 24 hours.

Buy SPANGRID, get quality

In any radiant heating, snow melting, ice rink or refrigeration installation, SPANGRID Steel Pipe can give you top job-site performance, assure years of trouble-free service. Try it! Your local Spang Distributor will be glad to serve you.

SPANGRID Steel Pipe is one of the many fine steel products produced by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pennsylvania.*

Architect: Thomas E. Moore, Denver, Colorado
General Contractor: Hugh-Hyder Construction Company, Denver
Heating Contractor: Builders Heating & Air Conditioning Company, Denver
SPANG Distributor: Central Pipe & Supply Company, Denver

ARMCO National Supply Division

SPANGRID Steel Pipe is bent hydraulically. Pipe rests on pea gravel based on 2-inch concrete and is covered with 3-inch finished slab.

HENRY VALVE CO.

CONTROLLING FLOW SINCE 1914

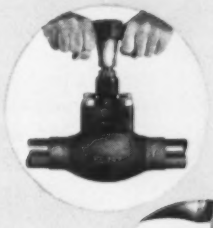
WING CAP SHUT-OFF VALVES

Globe and Angle Types with Bolted Bonnet and Full Capacity Flow

Henry offers the most complete range of sizes and types in the industry. Quality engineering, features of design, proven performance and adaptability to the most exacting specifications and diversified applications have made Henry Wing Cap Valves preferred by architects, consulting engineers, contractors and service men.

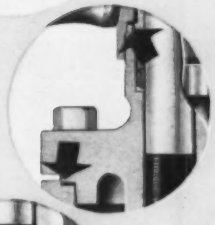
WING CAP SEAL

With Built-in Socket Wrench. For Ease and Convenience in Operating Valve Stem.



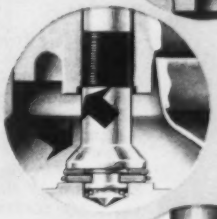
PROTECTIVE GASKETS

Fully Retained. Prevent Loss of Expensive Refrigerant.



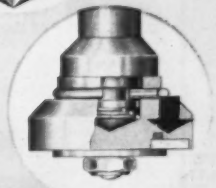
BACK SEATING STEM

Can Be Repacked Under Pressure.



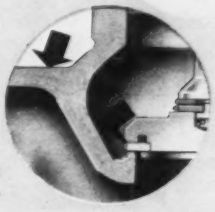
NYLON SEAT DISC

Replaceable, Non-rotating, Self-aligning, Chatterproof.



HEAVY WALL & WEB

Choice of Bronze Alloy or Semi-steel.



Bronze alloy valves have integral O.D.S. connections. Ductile iron valves available with integral F.P.T. connections; flanged type available with brass O.D.S. or steel butt-weld adapters.

HENRY VALVE COMPANY

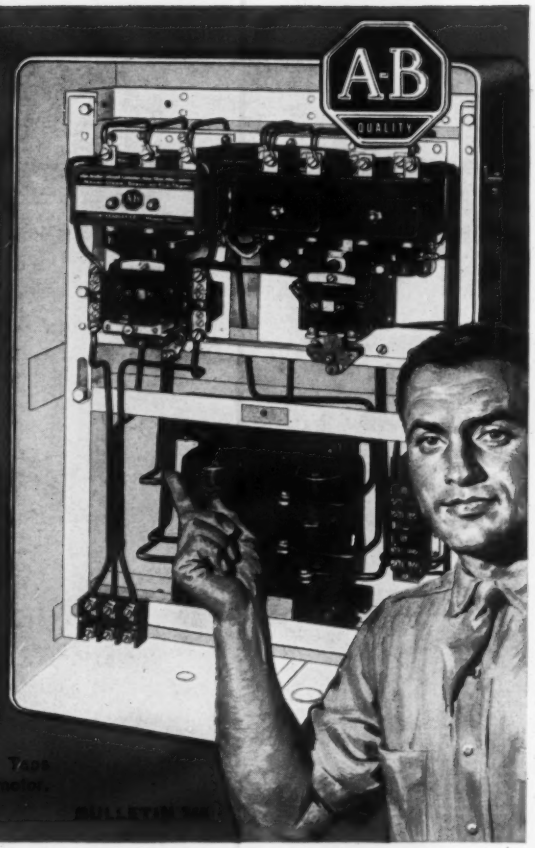
For Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILLINOIS, U.S.A. CABLE: HEVALCO, MELROSE PARK, ILL.

Where Reduced Voltage Motor Starting is Necessary...

Allen-Bradley has the best and most complete answer

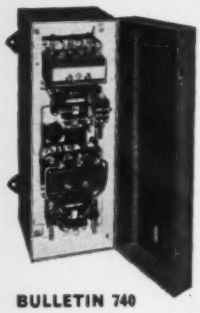
No matter what your reason for reduced voltage motor starting may be, Allen-Bradley has the *right* starter. Not only can the power company's requirements be satisfied exactly, but the A-B starter will at the same time provide the best possible starting conditions for the motor and the driven load. At least one of the starters described below will completely satisfy your operating requirements. For more detailed information, send for Publication 6088.



AUTOMATIC AUTOTRANSFORMER starter for squirrel cage motors that should not be started at full voltage. The autotransformer reduces line voltage during acceleration. Taps permit adjustment of voltage applied to the motor.

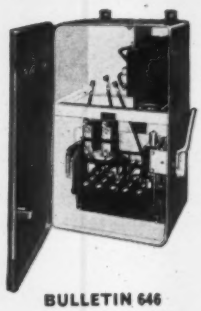
BULLETIN 640

MANUAL STEPLESS RESISTANCE starter has graphite compression disc resistors for velvet smooth starting of squirrel cage motors. Starting of the motor is under the complete control of the operator.



BULLETIN 740

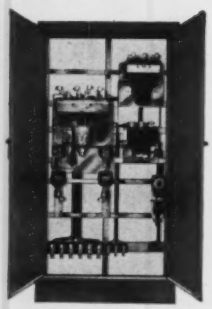
AUTOMATIC RESISTANCE starter has graphite resistors automatically inserted in series with the squirrel cage motor at starting. Resistors can easily be adjusted to motor and load conditions, giving velvet smooth acceleration.



BULLETIN 646

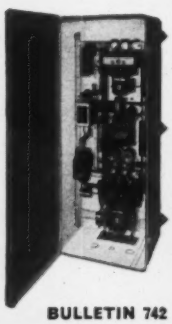
MANUAL AUTO-TRANSFORMER starter for use where load conditions or power company rules require reduced voltage starting. The air break starter shown has double break, silver alloy contacts.

AUTOMATIC MULTIPOINT RESISTANCE starter for use on network systems. Resistors inserted at starting are cut out in definite steps. Time intervals adjustable to provide velvet smooth starting.



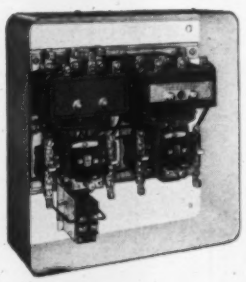
BULLETIN 741

AUTOMATIC STEPLESS RESISTANCE starter is not equalled for velvet smooth motor acceleration. It will satisfy any power company requirement. Eliminates lamp flicker on networks used for power and lighting.



BULLETIN 742

AUTOMATIC PART WINDING starter for use with squirrel cage motors having two separate parallel windings. Made in two-step type, and three-step type with resistance connected in the line on the first step.



BULLETIN 736

ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

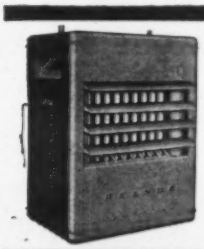
where to use gas-fired heaters in plants

Free from Reznor: Our just published handbook, "Industrial Applications of Direct Gas-Fired Heaters," tells all about the profitable use of Reznor heaters in manufacturing plants.

Use it to find out the many advantages—and economies, too—of using Reznor unit heaters for comfort heating of work or storage areas. For example, you can spot the heaters exactly where heat is needed, without installing long piping runs from a remote central boiler that may already be overloaded. You can use Reznor Aluminized or stainless steel duct furnaces for tempering make-up air or heating process air. Or use them in year-round heating and cooling systems. (Reznor duct furnaces are A.G.A.-approved for downstream applications.)

Among other subjects covered: How to blanket shipping doors, how to install heaters 40 ft. high to clear craneways; how to use Reznor heaters for stand-by operation on liquefied petroleum gas—with city gas as standard fuel.

Published by Reznor, the world's largest manufacturer of gas unit heaters, the handbook is yours free. Mail the coupon—or, call your Reznor distributor or district office, listed in the Yellow Pages under "Heaters—Unit."



REZNOR HEATERS

REZNOR MANUFACTURING COMPANY
Department HPA-10, Mercer, Pennsylvania
Send me a copy of "Industrial Applications of Direct Gas-Fired Heaters."

name_____ title_____

company_____

address_____

city_____ state_____

R/M RUBBER EXPANSION JOINTS AND PIPE

Precision engineered expansion joints overcome pipe expansion stress, insulate against noise and vibration, avoid misalignment.

- MAXIMUM RESISTANCE TO SHOCK
- GREATER RECOVERY FROM MOVEMENT
- NO EMBRITTLEMENT WITH AGE
- REQUIRES NO GASKETS
- ABRASION AND CORROSION RESISTANT

CONDOR FLEXIBLE RUBBER PIPE replaces pipe lines subject to noise and vibration. Outlasts iron or steel. No leaky joints at bends. Easy installation. Write for Bulletin M685.

CONDOR V-BELTS

For heavy industrial multiple belt units.

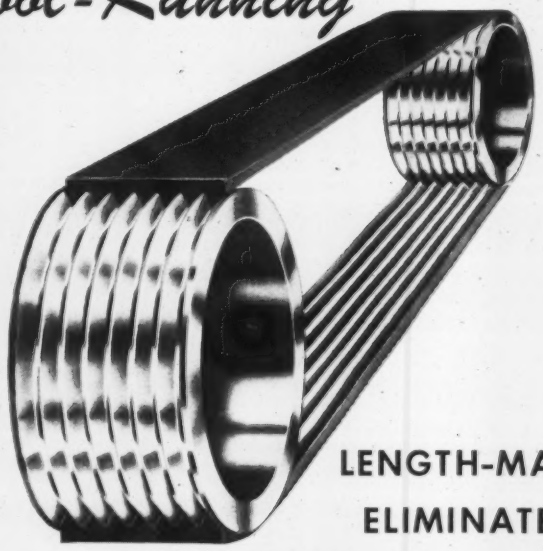
- PRECISION MADE
- SMOOTHEST RUNNING V-BELTS MADE
- MORE GRIP, LESS SLIP
- LONGER, TROUBLE-FREE SERVICE
- LOWER DRIVE COSTS

NEW R/M CX V-BELT*

- EXTREMELY QUIET... VIBRATION-FREE
- ONLY FULLY-MOLDED, FULLY-JACKETED NOTCHED V-BELT
- FOR SMALL PULLEYS
- FLEXIBLE, RUGGED, STRONG
- OUTLASTS OTHERS UP TO 8 TO 1
- NO FLEX-CRACKING
- HOLDS SHAPE AND EFFECTIVE LENGTH WITHOUT STRETCH

*Made for original equipment. Patented.

SMOOTH QUIET *Cool-Running*



LENGTH-MATCHING ELIMINATED WITH R/M POLY-V® DRIVE

For industrial air conditioning blowers, pumps and compressors—wherever heavy duty power equipment is required—*no* drive compares with patented R/M Poly-V! Major causes of V-drive trouble are engineered *out* of Poly-V . . . length matching problems are completely eliminated . . . drive-life is much longer . . . and just *two* Poly-V belt cross sections fulfill every heavy duty power requirement.

MORE POWER... LESS SPACE... WITH RELIABILITY

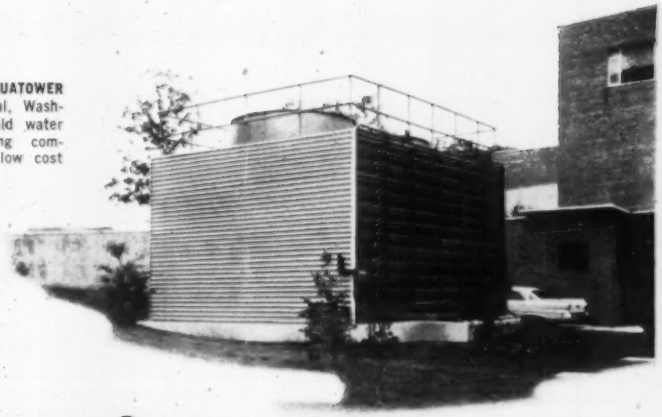
A single, endless V-ribbed belt runs smoothly over specially designed, precisely mating sheaves to deliver *equal* power in much less space than conventional V-drives—or much *more* power in the *same* space. Excessive vibration, noise, belt and sheave wear . . . all are eliminated with Poly-V. And Poly-V Belt *can't* sink into sheave grooves under loads; maintains complete contact-pressure, constant speed ratios for smoother, cooler, quieter running performance, no load to full load. Let an R/M representative show you how R/M Poly-V Drive can give you greater VIBRATIONLESS power delivery, greater drive dependability, longer life for your air conditioning or heating equipment applications. Write for Bulletin M141.

WHEN YOU CHANGE DRIVES...
CONVERT TO R/M POLY-V DRIVE AND BE SURE!

ENGINEERED RUBBER PRODUCTS ...MORE USE PER DOLLAR

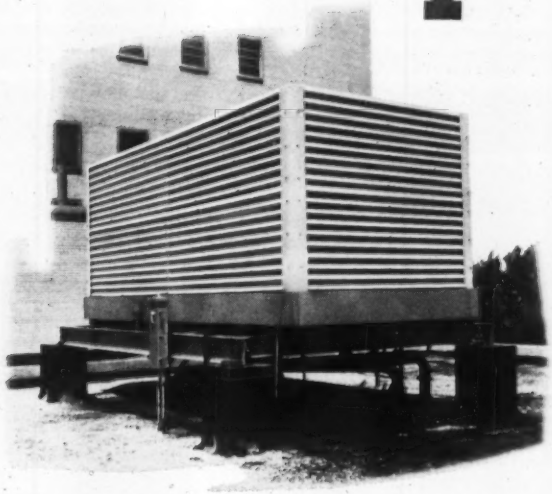
RM1008

RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY

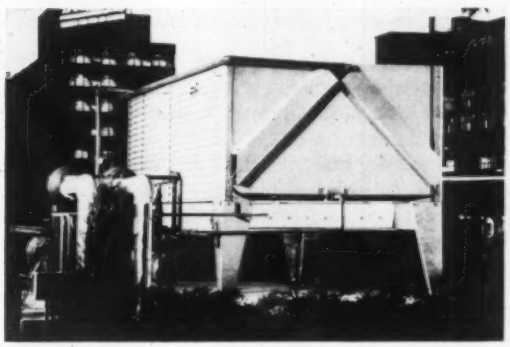


MARLEY DOUBLE-FLOW AQUATOWER at Sibley Memorial Hospital, Washington, D. C., provides cold water for large complete-building comfort cooling system at a low cost per gpm cooled.

In hospitals and wherever performance *is* paramount



MARLEY UNDERFLOW at Euclid-Glenville Hospital, Cleveland, combines minimum plan area, low height, high performance, compatibility and lowest operating and maintenance costs.



MARLEY DRICOOLER with winter control Damper automatically maintains uniform condensing temperature in year-around service at the research laboratory of a major agricultural products processor.

Pick any city (or cities), check the cooling systems of hospitals, laboratories, research facilities—other institutions where temperature control is critical—and you find that a broad majority have this in common:

MARLEY COOLING TOWERS AND AIR COOLED CONDENSERS

Why this widespread acceptance and approval of Marley products for the "chips down" jobs? Because they have in common three basic demands and Marley engineering fulfills them all, not just adequately . . . *impressively*.

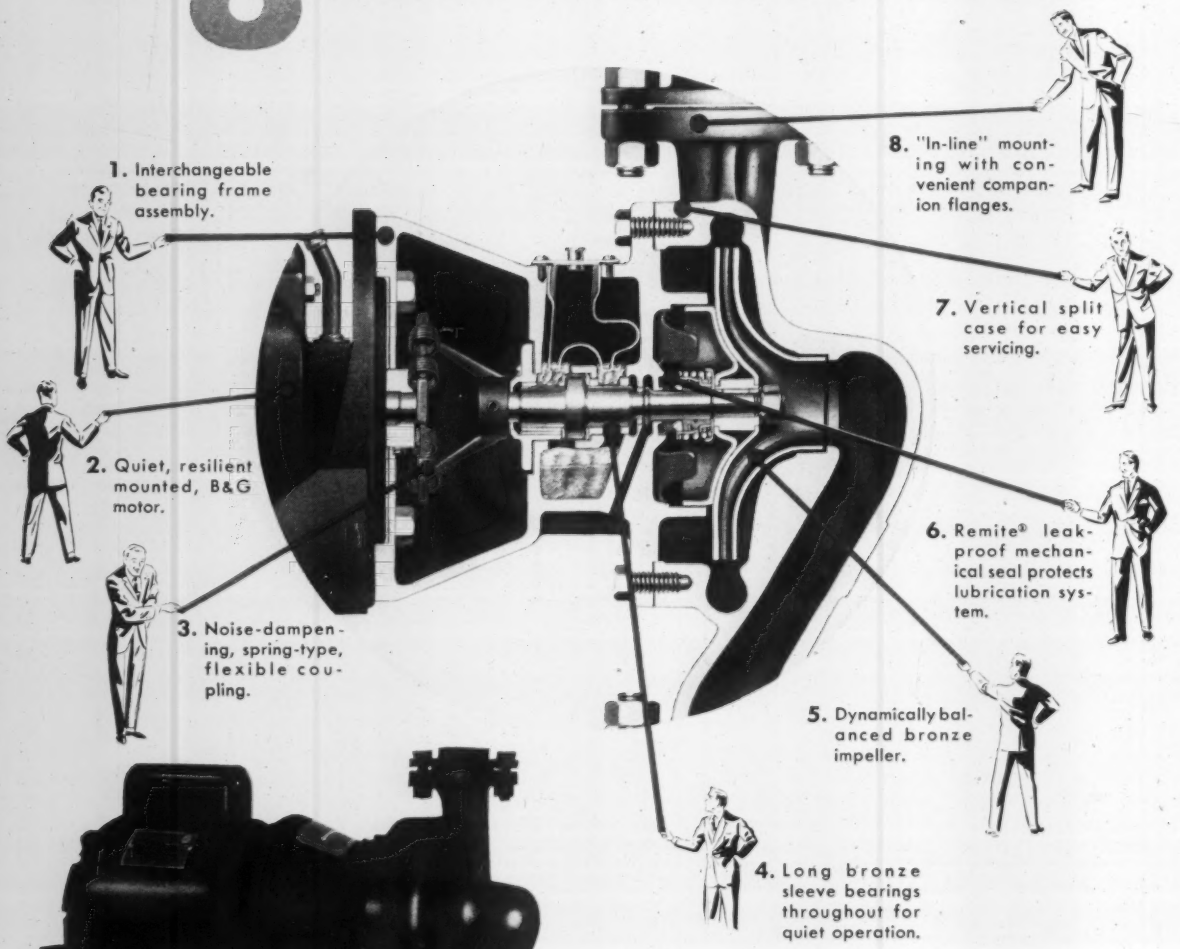
Performance Is Paramount—Full performance from start-up throughout a long service life is fundamental in Marley design. Every component is individually researched and rated; the integration of known-capacity elements into each Marley product invariably produces the yardstick by which similar products are measured.

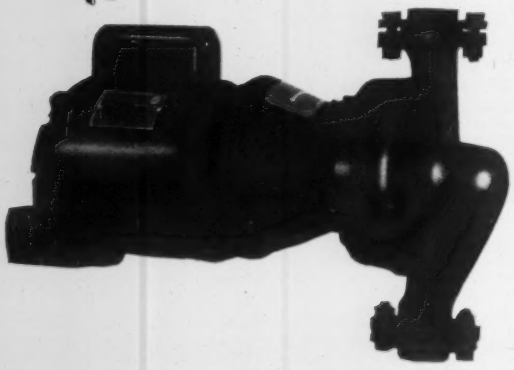
Durability Demonstrated—In thousands of installations Marley products daily (24 hours a day) prove the advantages of Marley structural and mechanical engineering that means rugged, rigid structures engineered to ignore corrosion, deterioration and vibration; that means fans and power transmission units designed and test-demonstrated specifically for cooling tower duty.

Maintenance Minimized—Inherent stamina of structure and mechanical equipment precludes major service demands; routine maintenance is simplified by complete accessibility to all product parts.

THE MARLEY COMPANY • KANSAS CITY 14, MISSOURI

A NEW VERSATILE PUMP WITH 8 REASONS FOR BETTER PERFORMANCE


1. Interchangeable bearing frame assembly.
2. Quiet, resilient mounted, B&G motor.
3. Noise-dampening, spring-type, flexible coupling.
4. Long bronze sleeve bearings throughout for quiet operation.
5. Dynamically balanced bronze impeller.
6. Remite® leakproof mechanical seal protects lubrication system.
7. Vertical split case for easy servicing.
8. "In-line" mounting with convenient companion flanges.



SERIES 60 IN-LINE PUMP

Designed for air conditioning and refrigeration systems, cooling towers and general service

This new "in-line" pump has all the inherent features of B&G Booster and Universal Pumps which have been accepted as standards for quiet operation. The compact design of the Series 60 saves space... vertical split case construction and interchangeable parts permit easy servicing... in-line mounting simplifies installation.

AVAILABLE FROM STOCK

Series 60 Pumps are carried in factory stock as bronze fitted units in four sizes, with heads to 29 ft., capacities to 100 GPM, working pressures to 175 psi. When built to order, they are available as all-bronze, all-iron and bronze-fitted units. Both stock and built-to-order units operate at 1750 RPM.

As presently manufactured, Series 60 Pumps from stock can be installed only in a vertical position. If horizontal mounting is required it must be so specified on order.

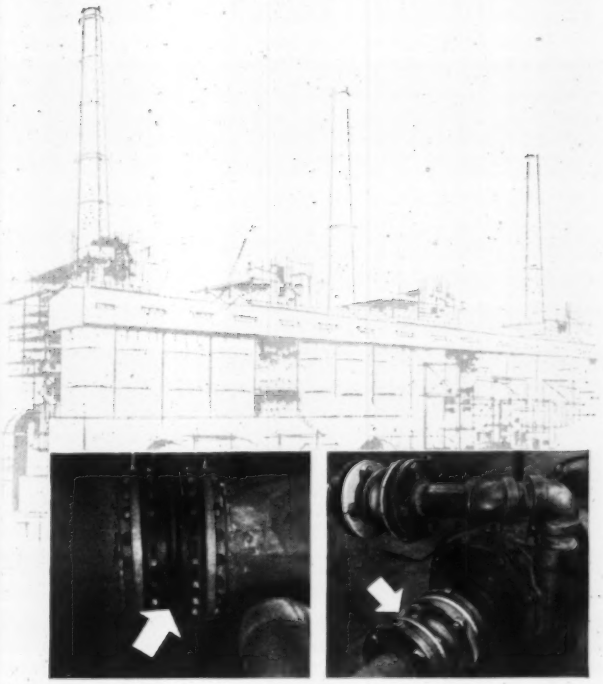
Write for complete information or see your wholesaler

BELL & GOSSETT
COMPANY
Dept. GV-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

ENGINEERED PRODUCTS

for Plant Maintenance



Typical installations show Garlock Rubber Expansion Joints on a 26" vacuum condenser inlet (left) and 2½" suction and discharge pipes. Garlock furnishes standard joints from ¾" to 72" in pipe diameter, and in all shapes.

Install Garlock Rubber Expansion Joints. It's good piping practice; here is why:

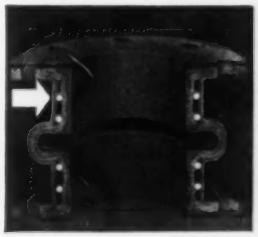
1. Prevent stresses. Piping systems expand and contract with temperature changes. Garlock Expansion Joints act as a "breather" . . . compensate for expansion and contraction.

2. Eliminate vibration and noise. Pumps, compressors, engines, and pressure surges in pipe lines create vibration and objectionable noises. Garlock Rubber Expansion Joints act as an absorbent cushion . . . reduce vibration and insulate against transfer of noise to other parts of the building.

3. Compensate for misalignment. Piping and mechanical equipment often move out of normal alignment during operation due to wear, load stresses, or settling of buildings. Garlock Rubber Expansion Joints compensate for this and prevent possible breakdowns of equipment. They also make installation easier since alignment of piping and equipment need not be as accurate when expansion joints are used.

4. Reduce flange breakage. Undue stress caused by misalignment, vibration, expansion or contraction of piping or equipment, will break the metal connecting flanges. Garlock Rubber Expansion Joints relieve such stresses.

Offer many application advantages. Garlock Rubber Expansion Joints outlive metal ones; do not crack, corrode, lose shape, or require gaskets. The sturdy construction of Garlock Rubber Expansion Joints results in satisfactory service where pressures are as high as 150 p.s.i., temperatures to 180°F.



Expansion joints are also available for service up to 450°F. In the photo of the joint cut in half, the arrow points to a steel reinforcing ring which, when varied in number with the joint size, provides the extra strength needed for the most severe applications.

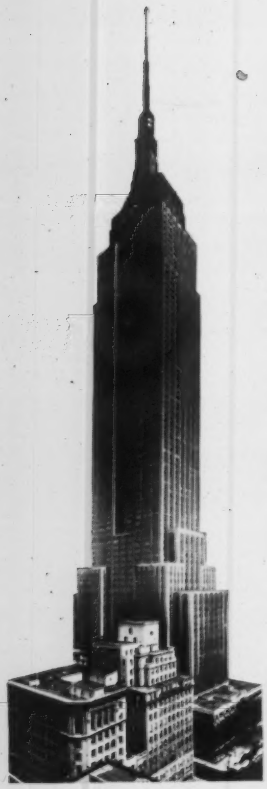
For more data, call the nearest of the 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-137, Garlock Inc., Palmyra, N.Y.

GARLOCK

Canadian Div.: Garlock of Canada Ltd.
Plastics Div.: United States Gasket Company.

Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

*DuPont Trademark



How Empire State Building and American Airlines solved vital fire protection problems with EVERLASTING VALVES

102 stories, 1,472 feet high, 16,000 tenants and 35,000 visitors sum up the fire protection problem of the Empire State Building. An in-building fire protection system is necessary to an unfailing water supply.

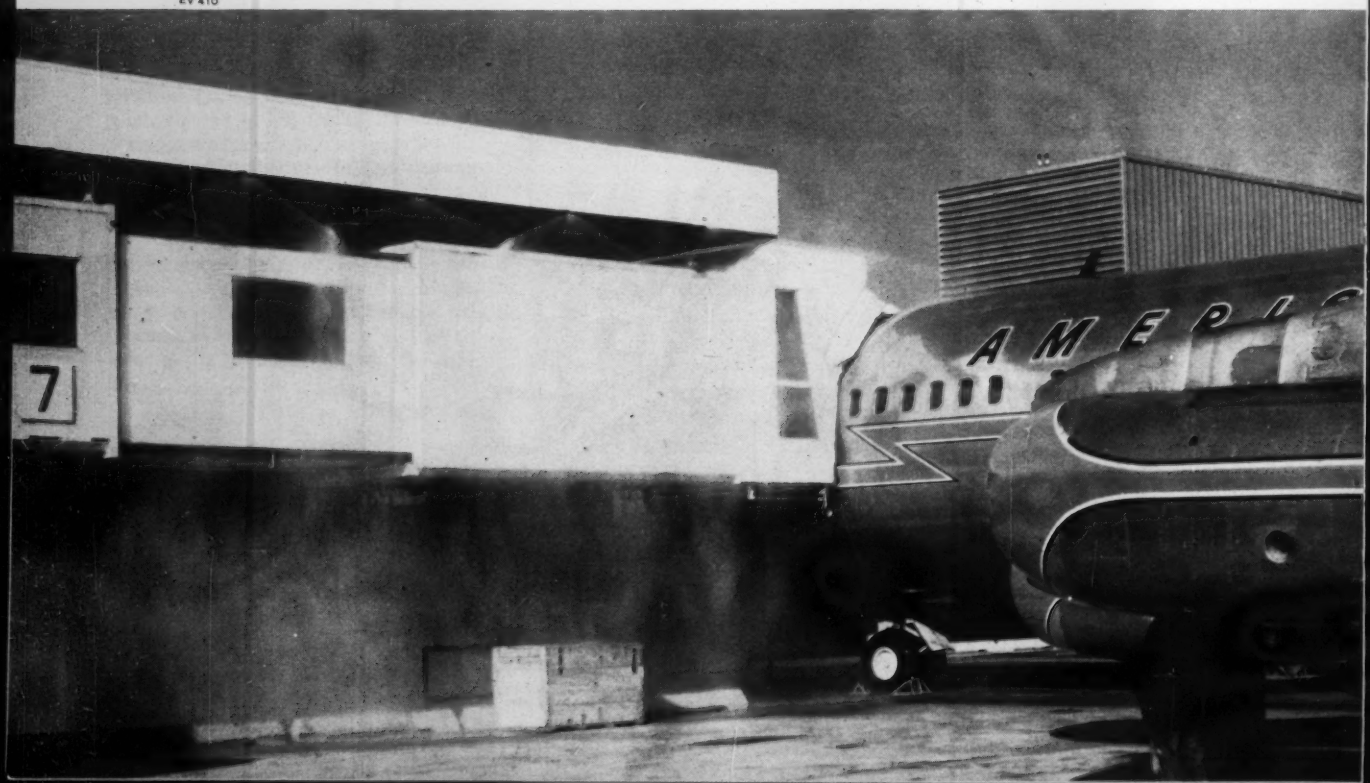
American Airlines loading bridge, shown below, gives passengers positive protection against fire with a unique deluge system.

Both these fire protection systems depend on Everlasting Pendulum Stop Valves, which have been installed in thousands of critical fire protection systems over the past 35 years.

For complete information on the unique American Airlines and Empire State Building systems, write for bulletins F. They include an editorial description of both these installations and a bulletin describing Everlasting's positive action pendulum stop valves.

Everlasting also makes a line of quick-opening valves for general service, boiler blow-off, and handling viscous materials, as well as a line of cylinder-operated valves. Bulletins on all these valves are available. **Everlasting Valve Company, 61 Fisk Street, Jersey City 5, New Jersey.**

EV 410



High Temperature Water vs. Steam
for space heat, process heat, air conditioning

C-E makes *both* types of equipment. Here are the facts:

High temperature water systems are coming into wider use — not only for space heat and process heat applications, but for use with absorption air conditioning equipment as well. Customers have ordered some 80 High Temperature Water Boilers (Type HCC) for these purposes, with plant capacities ranging from 10 million to 300 million Btu/hr, and operating at water pressures up to 500 psi and temperatures to 470F, or higher.

The "Thermal Flywheel"

With a steam system, boilers often have to be operated constantly at full load. Wide load swings can cause loss of steam pressure and considerable lag before sufficient steam can be supplied. But because a high temperature water system has a far greater heat storage capacity than a steam system at the same pressure, even sudden large demands will not drain heat from consuming units. Thus fluctuating demand does not immediately affect boiler loads. Boilers operate at a more constant rate which improves the efficiency of the entire system. In industrial applications, temperature of ovens, tanks, calender rolls, heating platens, etc., can be controlled within close limits, which often results in improved product quality and increased production.

Savings with High Temperature Water

While capital costs for steam generators and high temperature water boilers of equivalent capacity are roughly the same, a system using a C-E Hot Water Boiler can usually save from 10 to 20 percent in operating and maintenance costs:

1. No steam traps. This means substantial savings in initial cost, plus further savings by eliminating trap maintenance. Steam losses due to normal trap operation are also eliminated;

2. No blowdown required. This represents a considerable loss in steam systems, reflected in increased fuel costs;

3. No pressure reducing valves. Initial valve cost is reduced and losses from improper valve regulation are prevented;

4. No pipe grading required. The system is always under pump pressure. Piping can be carried over machinery, in roof trusses, up or down grades — even underground. Pipe life expectancy is increased many times since corrosion is minimized in a closed oxygen-free system;

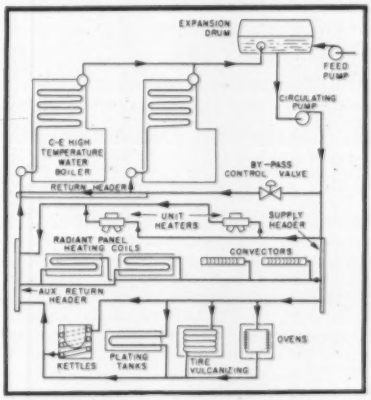
5. No condensate return lines. And no investment outlays for corrosion prevention; cost of replacing wet returns is eliminated;

6. No expensive feedwater treatment. Since only small quantities of make-up water are needed, treatment can be handled on a batch system basis.

Versatility of High Temperature Water

For heating units such as space heaters, radiant panels, etc., high temperature water may be used directly. For domestic heaters, ovens, tanks, vulcanizing equipment, etc., it can be used indirectly — as low temperature hot water or as steam — produced in suitable heat exchangers.

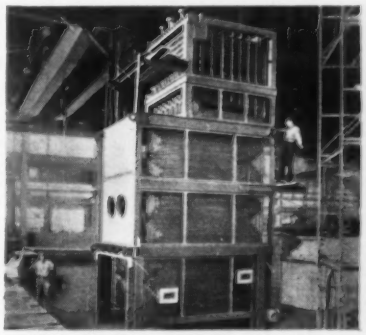
In addition, high temperature water is well-adapted to use in the coils of absorption refrigeration units — for cooling, as well as heating, multi-building applications. Absorption equipment can be located in each building and can operate without the supervision of licensed engineers, at a considerable labor saving.



A simplified schematic arrangement of typical high temperature water applications in industrial or commercial plants. Shown are the Type HCC boiler, expansion tank, circulating pump and actual heat consuming units. Heat exchangers for conversion to low pressure hot water are also used frequently in these systems.

The C-E High Temperature Water Boiler

C-E High Temperature Water Boilers are designed around the same controlled circulation principle used by C-E in many of the world's largest steam generation units. They can be fired by oil, gas, coal or any combination of these fuels. They operate with low pressure loss, provide complete control of system and boiler circulation, and offer optimum arrangement of heating surfaces. All circuits are drainable and headers are accessible from outside the boiler casing. With no baffles in the boiler, there are no areas where soot can accumulate. Symmetrical arrangement of heating surfaces permits a rugged, gas-tight casing construction which can be pressure fired and is entirely suitable for outdoor installations.



A 30 million Btu Type HCC boiler partially shop assembled, showing compactness of the unit. Upon addition of refractory and welded casing, boiler will be lifted by its lugs onto a flat car for shipment.

The standardized design of these units results in lower first cost, shorter delivery time, lower cost of ownership. Smaller sizes are completely shop assembled, while larger sizes are shipped in component assemblies, to reduce field erection costs.

You be the Judge

Because most operators, engineers and contractors are more familiar with steam than with hot water systems, we have gone to some length to enumerate the major differences between the types. Naturally, needs vary, and the eventual choice of a heating system should be made only after a thorough investigation of all factors.

Our engineers will be pleased to discuss either hot water or steam units, or both, with you and your consultants — impartially and with no obligation. For further details on high temperature water boilers, write for catalog HCC-2.

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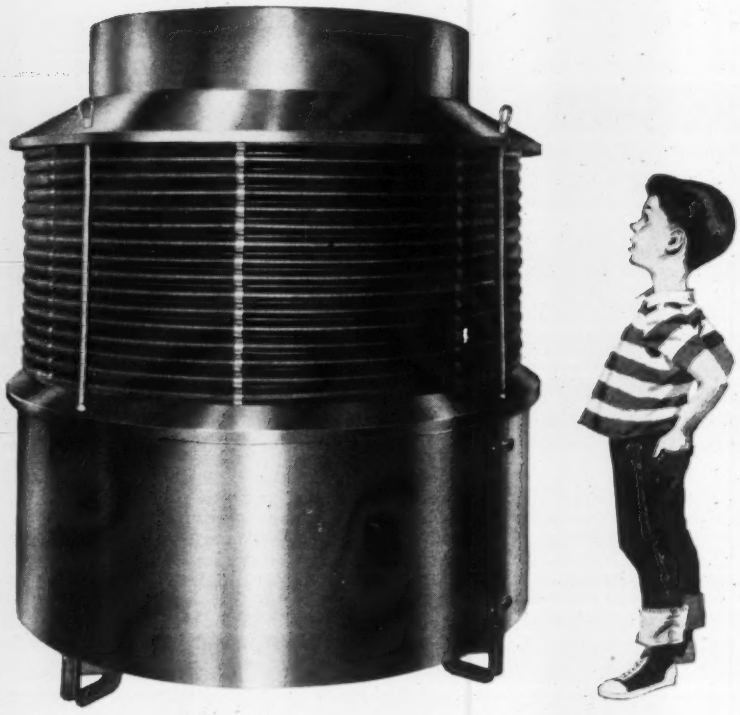

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3-30 HP (single compressor)
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We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"Open for Discussion"

Colleges Are Special Cases; Require Special Designs

I HAVE READ Evert Johnson's article, *University Has Expansion Flexibility in HTHW Heating and Cooling System* in the September issue, and I have found it both interesting and timely. I realize that college campus heating and cooling systems constitute a small fraction of the total heating and cooling installations in the country. However, their unique requirements are such that they deserve wider consideration than is generally accorded them. Engineers are prone to consider a college system as another public school project and apply the familiar school criteria.

This is far from the case, for public schools are usually isolated buildings while a college campus is a collection of buildings with a high occupancy for about six hours a day. College buildings are frequently less than half classrooms, devoting much of their space to laboratories, offices, libraries, studios, and other special purpose rooms. This means a much lower occupancy, but more use hours. It is not unusual for urban colleges to use their buildings 14 hours a day.

It is only natural that for many years little thought was given to the special requirements of college heating systems, for there was little college building construction. However, today most colleges, large and small, are building or planning expansion to take care of the increased number of students being graduated by the high schools, and it is only proper that we give their needs the consideration they deserve.

High temperature hot water systems are particularly well adapted to campus heating and should receive wider acceptance for this purpose. Probably the principal reason for this lack of acceptance is that most colleges have been in existence for many years and have a central steam plant. Nevertheless, it will very likely receive much wider use in the new construction now being planned, for it has a number of attractive advantages.

W. M. PETRY
Professor and Head
Mechanical Engineering Department
College of Engineering
The University of Akron

Questions Test Methods for Determining Moisture Migration

THE DATA presented by R. J. Zablodil in *Tests Reveal Moisture Migration Rates Through Variously-Constructed Walls* in the September issue include some surprising results. Especially notable is the comparison of Walls No. 3 and No. 9. The construction of No. 9 includes all of No. 3 plus brick and mortar and a coating of coal tar pitch. These additions should of course reduce the rate of moisture transmission. Some reduction is seen at 65 F, but at 78 F the transmission rate of No. 9 is 84 percent higher and at 102 F it is closely the same as No. 3. This requires explanation.

The comparison of test results can be more reliably made when the observed rate is divided by the vapor pressure difference. A further reduction to (grains per hr) (sq ft) (in. Hg) or "perms" expresses the permeance in a unit generally used in the building industry. On this basis, nearly all results fall between 0.9 and 1.5 perm. This small range of permeance in the wide range of construction prompts a careful

"Open for Discussion"

Continued

review of the test methods. I would question if a steady state could be dependably established in the times allowed. To insure true results, I would suggest that the rate of moisture entrance should be measured and compared to the rate of exit.

It should be noted that diffusion (as provided in these tests) is actually not the only mechanism of moisture transfer through building walls. In tests that I have made on large dehumidified warehouses, infiltration of air as a result of wind pressure was found to be the principal means of moisture entrance, even through a bituminous coating sprayed on concrete block walls.

F. A. Joy
Professor of Engineering Research
Engineering Experiment Department
College of Engineering and Architecture
The Pennsylvania State University

The Author's Reply — An analysis-of-variance test was performed on the data to test whether vapor pressure differentials on moisture rates and wall samples had significant effects. This analysis showed that there is a highly significant (beyond the 99 percent confidence level) variation in the moisture rates as a result of the vapor pressure differentials.

There was no significant effect due to walls upon the moisture rates. In other words, these conclusions are a strong indication of the statistical adequacy of this test method.

A normal variability can be expected of any test which does not have a high degree of repetition. The differences in moisture rates observed are readily ascribable to variations normal to such a test.

The test as performed was designed to be a balance between validity of conclusions and cost. The NCEL test was small enough to be performed with modest funds, yet large enough to give statistically valid results.

Obtaining steady state depends largely on wall samples being at equilibrium moisture content. The samples were built in mid-1955 and were permitted to season for about a year. Approximately 1-½ years were spent in striving for valid results using the cooling-coil-at-dew-point-temperature method. This is the method that gave erratic results, and which was discarded for the dessicator method.

The dessicator plan was in use from mid-1958 until the end of the test — May 1960. During this period, when a sample was installed in a test cell, it was first permitted to soak with the high side vapor pressure at test condition but the vapor pressure on the low side held at slightly below the low side test condition.

The pressure on the low side was maintained by a portable dehumidifying machine. After soaking the wall at this "hold" condition for from three to five days, the machine was disconnected from the system.

The vapor pressure on the low side was then permitted to rise naturally until it reached the low side test condition. This took from three to six hours, depending on the sample. When the test condition was reached, the desiccator valve was opened. Pressure fluctuated slightly until the correct setting of the valve was found, but from then on was held steady. This assured us that steady state had been established.

With regard to wind affecting moisture migration rates, what Professor Joy says is true. However, the NCEL test was based only on vapor pressure differentials, much like the C and k factors are based on temperature differentials. If wind pressures had been simulated, rates undoubtedly would have increased.

The NCEL tests have certain advantages over wet or dry-cup or field tests. First, the wall samples were approximately 6½ ft square, which reduced the homogeneity effects quite often prevalent in small samples. Second, the relative humidities were not the extremes of wet or dry-cup tests where the relative humidity on one side is either 100 percent or zero. Third, for each test the relative humidities and dry bulb temperatures (vapor pressures) were held steady, a condition unobtainable in field tests.

R. J. Zablodil
Director
Environmental Control Div.
U.S. Naval Civil Engineering Laboratory

Objects to Report On ASHRAE Meeting

I am counsel to the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., and, as such, write this letter to you on behalf of the Society, its officers, directors and members regarding the article entitled *ASHRAE Lab to Remain Closed Without Membership Referendum* in the August, 1961 issue of Heating, Piping & Air Conditioning and particularly the paragraph therein reading as follows:

> "When the vote was called for, it was pointed out that all the proxies for the election of officers previously signed by members not planning to be present would be voted in favor of Mr. Palmatier's motion. As a result, the motion was passed with a large majority."

The statements of fact contained therein are untrue, false and, in my opinion, libelous, except that the motion was passed by a large majority.

At the meeting in Denver at which I was present and which was held on the morning of June 26, 1961,

Continued on page 105

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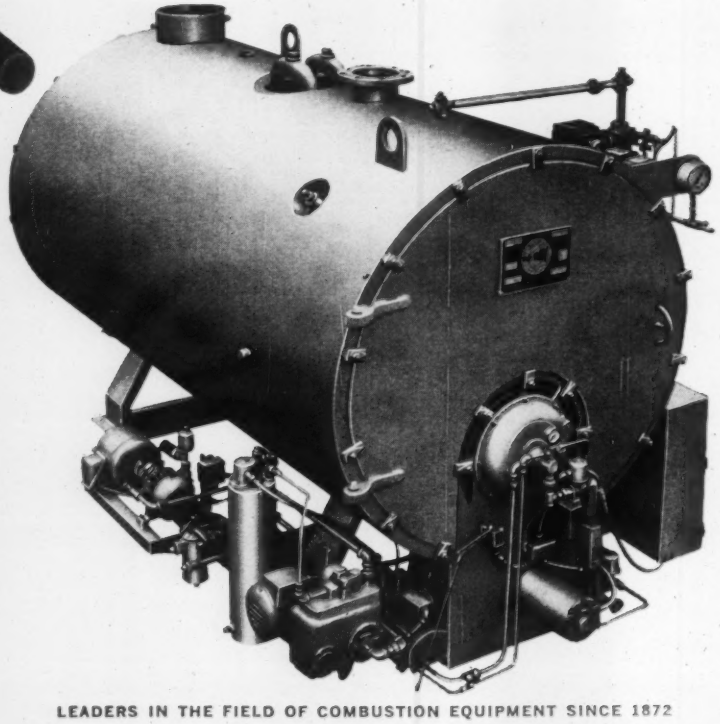

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"Open for Discussion"

Continued

Mr. Palmatier presented his motion and the same was discussed in open meeting and at length by various members of the Society. The minutes of that meeting show that at no time during the meeting was it pointed out or stated that the proxies would be voted in favor of Mr. Palmatier's motion. The President, who was Chairman of the meeting, after the discussion, again read the motion and then the following appears in the minutes:

> "Mr. Wagner: Point of order. How are the proxies going to vote?
>
> "President Tull: This is up to the proxies.
>
> "Mr. Wagner: With this procedure, aren't the proxies in a position to judge by who is here and who is over here, and you have a group over here that haven't said how they are going to vote. You have got people on this side who can vote two ways and a group on this side.
>
> "Mr. Vreeland: May I make this statement. It is true that everyone who has sent in a proxy and who wishes his proxy to cast a ballot or the vote in accordance with the discretion of the proxy does not know, and I don't know, how the proxies are going to vote. Therefore, if you have sent in a proxy and you have a definite way you wish to vote, then the only safe thing to do is to withdraw the proxy and vote in person. However, those members who sent in proxies and who are not present, the proxies, pursuant to their direction,* will cast their vote in accordance with the terms of the proxy."
>
> (*Writer's Note: This is an error and the word used by me was "discretion.")
>
> "Mr. Holladay: Mr. Vreeland, will you read the names of the proxies?
>
> "Mr. Vreeland: The names are: Edward R. Searles, R. G. Pritchard, and D. D. Pearsall."

The minutes show it was emphasized that the proxies had the right to and would exercise their discretion in voting on the motion.

The innuendoes contained in your article intimate that the proxies were instructed how to vote, which would raise in any normal person's mind a presumption that the proxies were not completely and entirely free to exercise their discretion in casting their ballots. Such an impression would clearly adversely affect the Society, its officers, directors and members because it would be attacking their impartiality and fairness and tend to hold them up to ridicule, criticism and censure.

The Society feels, therefore, that the least your publication should do is to promptly print a retraction of the misstatements made.

Trusting that I may hear from you without delay, I am

S. B. VREELAND
Attorney and Counselor at Law

Questions Application of Data on Streamlined Heat Exchanger Tubes

IN THE "HPAC Report on Research" in the February issue entitled, *How Finned Streamlined Heat Exchanger Tubes Perform*, by David M. Adams it is not completely clear to me whether a single tube was tested, or a single bank of tubes, although the former is suspected. If a bank of tubes was tested, the spacing should be given, since the results would be influenced by this parameter; for example, as the tubes are moved closer together the velocity between the tubes increases, for a given frontal velocity, resulting in higher pressure drops and improved heat transfer coefficients. For this reason I would take issue with the statement " . . . could apply equally as well for its use as a single bank evaporator or condenser." Also, in the interests of completeness and as an aid to application or further analysis of these results, it is suggested that the definition of hydraulic diameter employed in the Reynolds number be clearly stated in order to allow direct comparison with similar data in the literature.

Does Heat Transfer Vary?

It is observed that the author measures a heat transfer conductance for the streamlined bare tube which is approximately 50 percent higher than that for the circular bare tube at the same Reynolds number in Fig. 3. Since the perimeters and lengths are stated as equal, this would imply a 50 percent higher heat transfer coefficient. This deviates substantially from the data of Hughes for a similar streamlined tube (see McAdams, *Heat Transmission*, Third Edition, p. 265), in which it was found that the heat transfer coefficients for bare streamlined and circular tubes of the same perimeter were about equal.

Also, by means of some mathematical manipulation between Figs. 3 and 4, it is possible to deduce the value of the air side heat transfer coefficient. Assuming the hydraulic diameter to be the actual diameter for the circular tube, and assuming a mean air temperature of 150 F, it was found that the Nusselt number at a Reynolds number of 10,000 was approximately 75 to 80, whereas the generally

"Open for Discussion"

Continued

accepted value (McAdams, p. 259) is only 56.5.

It has long been felt that the form drag associated with the circular tube construction represents wasted energy, and these results certainly seem to substantiate this hypothesis. There is, however, a restriction which the author has noted, but which bears emphasis. That is, that the results, as presented, are only valid for single tubes. It has been experimentally confirmed, for example, that in multi-row coils employing circular tubes the vorticity created by the first row is not entirely wasted, but contributes significantly to increased heat transfer coefficients for the rows behind. Consequently, it is unlikely that the advantages claimed for single tubes can be fully realized for coils of multiple rows.

DONALD G. RICH
Senior Engineer
Carrier Research And Development Co.
Carrier Corp.

THE AUTHOR'S REPLY — With regard to the points raised by Mr. Rich:

Perhaps the statement on the applicability of the test results to a single bank of tubes should have been qualified to indicate that the general trend toward higher heat transfer rates and lower pressure losses would only be obtained if the fin-tube spacing was relatively close. It is also realized that the fin-tube spacing will affect the characteristics of one type of finned tube more than another. A financial problem prevented the testing of a greater number of tubes.

McAdams defines the equivalent diameter as the total wetted perimeter of a surface divided by π. Since both perimeters are equal, their equivalent diameters are equal.

The primary factor that possibly caused the higher values was the air stream turbulence, or vorticity, before the test section. Thermocouples were strung across the duct to measure the temperature of the inlet air. A wooden duct was chosen over a sheet metal one because of its ability to withstand dimension changes due to a pressure difference between the inside and outside of the duct.

The wooden duct, in consequence, was rougher than a sheet metal one. These two factors, coupled with the small duct size, created a large amount of air stream turbulence. The effect of upstream turbulence on heat transfer is well known.

This was observed in comparing results of the bare circular tube with those given by Griffiths and Awbery. Their test setup was very similar to the one used here. They used an air straightener before the test section which increased the air stream turbulence. In short, the Reynolds number over a test section tells nothing about how much vorticity or turbulence exists upstream.

It is realized that the heat transfer coefficient in multiple banks is affected by the turbulence produced by each bank. The above can be used to explain this. However, even though the finned streamlined tube produced less turbulence than the finned circular tube, the turbulence would still have an effect on following tubes or banks. The effect would not be as significant, however. The important thing to remember is that the heat transfer coefficients were increased by virtue of the utilization of the increased temperature zones rather than by increasing the turbulence.

The fluid properties were evaluated at the bulk temperatures rather than at film temperature because, for the finned surfaces, the latter have no meaning. Thus, a comparative analysis was made using the bulk temperatures.

DAVID M. ADAMS

What Are Specific Costs, Hours For Maintenance Program Courses?

AS DESIGN architects-engineers for numerous hospital facilities throughout the country, we are pleased to see the start of a maintenance training program discussed in the article, *How to Start a Maintenance School*, by Richard T. Danks in the August issue.

The program as outlined and as analyzed for a solution certainly has considerable merit in the field of improved maintenance, especially for hospitals where the problem is so complex.

While it is described in general terms, the program appears to fulfill all the needs for improvement of personnel in this area. This should be of interest to many similar institutions and on this point perhaps Mr. Danks could be encouraged to impart the following information:

Minimum number of men required to institute such a program.

Estimated number of years required of each man to complete the course.

Hours per month of instruction time and anticipated hours per month of study time per man.

Total cost per man per year.

We compliment Mr. Danks on his article and also his ability in having convinced the executive staff of his institution to carry out this very worthwhile program.

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Chief Executive Engineer
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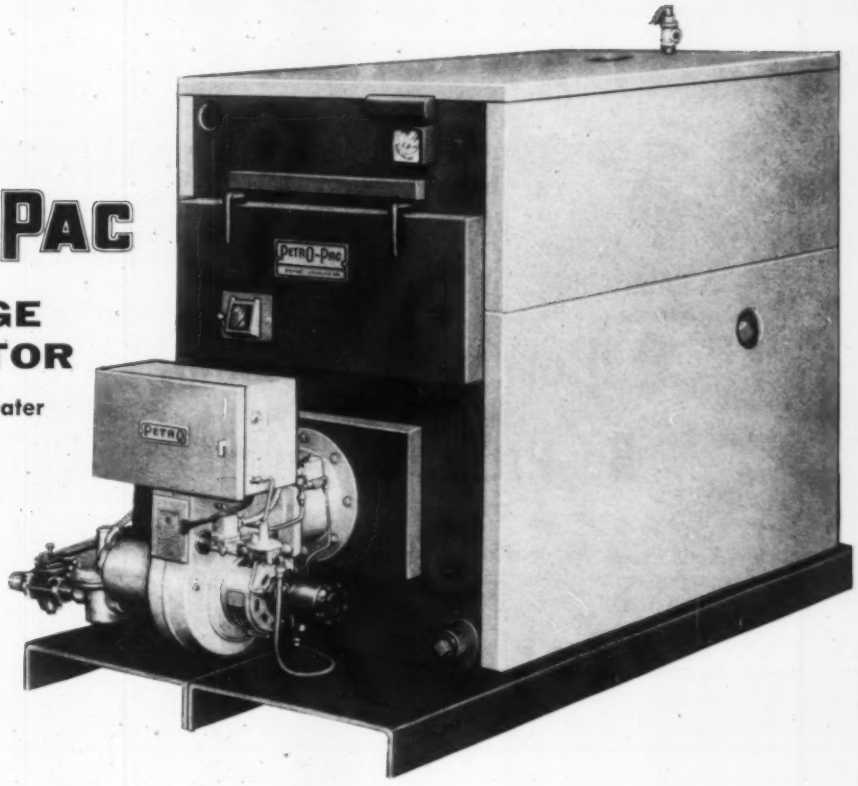

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question of the month

"How Should Radiant Heating Be Protected from Freeze-Up?"

"We would like to know what measures should be used in protecting radiant heating systems installed in floor slabs against freeze-up when the system is shut down for repairs or is on low demand.

"Our primary interest is to learn what chemical anti-freeze solutions have been used with success without risking any possibility of corrosion being caused in the piping system. We realize that one method that will probably be suggested will be to keep the pumps circulating constantly. However, this is not practical in all cases, and we would like to learn from other readers what experiences have been encountered."—R.J.T.

Combination Freeze-Corrosion Protectors Are Available

THE QUESTION raises two points; one has to do with protection against freeze-up; the second with the prevention of corrosion within the recirculating water system.

A radiant heating system installed in floor slabs can be protected against both freeze-up and corrosion by the use of one or more proprietary products. These consist of properly inhibited ethylene glycol, and can be safely used in any piping system. The corrosion inhibitor concentration is generally such that adequate protection can be achieved with as low a concentration as 10 percent of the glycol by volume in the system.

Since one of the primary functions of the corrosion inhibitor in an ethylene glycol solution is to prevent the accumulation of break-down products, it is necessary to periodically have the ethylene glycol brine tested to be certain that an adequate reserve concentration of inhibitor is present. Most manufacturers of these products maintain such a service and will usually agree to perform the analysis on about a once-a-year basis.

The concentration of the properly inhibited ethylene glycol to be maintained in a system will depend upon the lowest temperature to which the recirculating water system will be exposed. The owner can obtain the proper concentration by advising the manufacturer of the temperature requirements of the system.

F. S. HODGDON
Associate Chief Engineer
Metropolitan Refining Co., Inc.

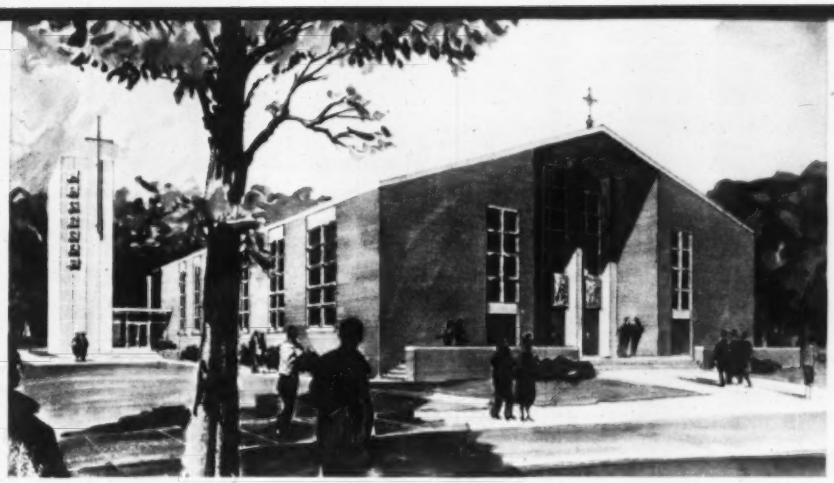
Use Ethylene Glycol; Watch Flow Rates, Pumping Heads

AN ETHYLENE GLYCOL solution may be used to afford freeze-up protection to slab-installed radiant heating systems. R.J.T. does not mention ambient conditions for the system in question, but generally a 35 to 40 percent volume strength is satisfactory. The following Table lists mixture freezing temperatures as a function of solution strength:

Freezing temperature, F	Glycol volume, percent
20	15
16	20
10	25
0	32
−10	38
−20	44
−30	49
−40	52

The quantity of anti-freeze which will be required is influenced by liquid capacity of the system. This value is easily calculated, knowing pipe sizes and lengths, and the volumes of the expansion tank and the boiler or converter.

Since the specific heat of most anti-freeze compounds is less than that of water, its use may require greater mass flow rates. Once the required solution strength has been determined, the specific heat of that mixture can be plotted against variations in temperature to determine the flow rate that will be



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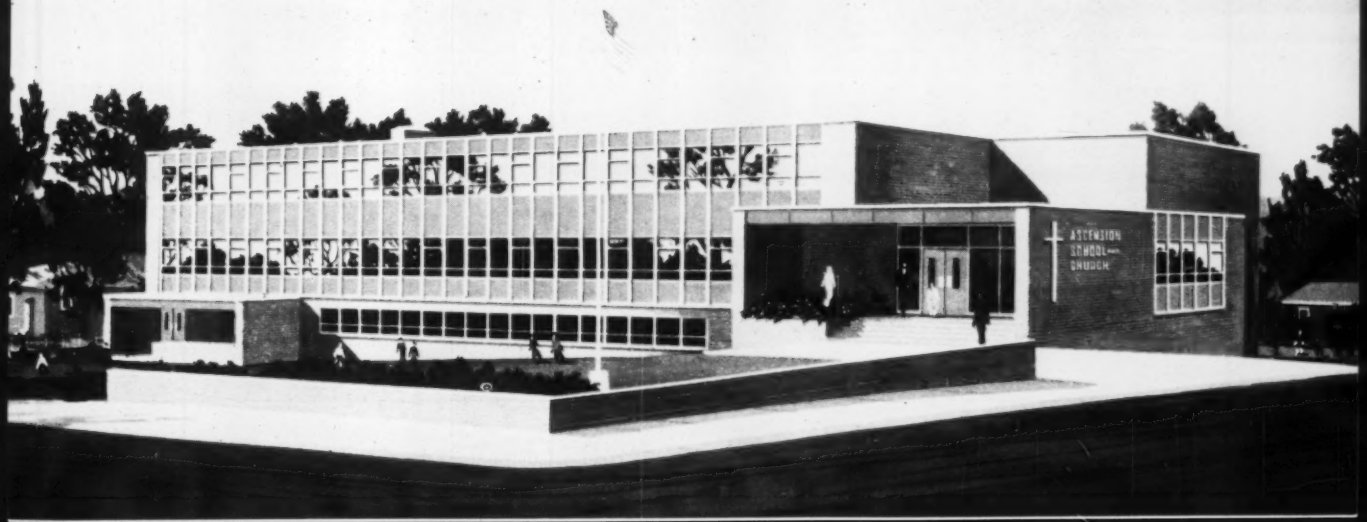


question of the month

Continued

required. Also, due to changes of viscosity and specific gravity values, heat transfer coefficients may be less, requiring larger surface areas.

The viscosity of ethylene glycol is higher than that of water, causing greater friction loss of different mixture strengths as related to temperature.

Because of its toxicity, a system containing an anti-freeze compound should be isolated from any potable water supply. Some cities have specific requirements regarding this safeguard, which must be adhered to.

R.J.T. does not indicate materials of construction for the piping and accessories. An inhibitor should be included with the ethylene glycol to limit corrosion. The inhibitor will provide alkalinity for neutralizing rusting, maintaining the solution within the necessary pH range. Triethanolamine phosphate is one of several compounds which can be used for this service.

Even though an inhibitor is used, the anti-freeze solution should be tested for acidity at least once a year. Reduction of inhibitor strength may result from corrosion products, which are slightly acid. Leakage of air into the system is another possible cause. If the test results show inhibitor strength has been lowered, the system should be drained and charged with a fresh solution.

H. B. WAYNE
Consulting Engineer

READER ASKS —

"What Are the Use Limits On a One-Fan Supply/Exhaust System?"

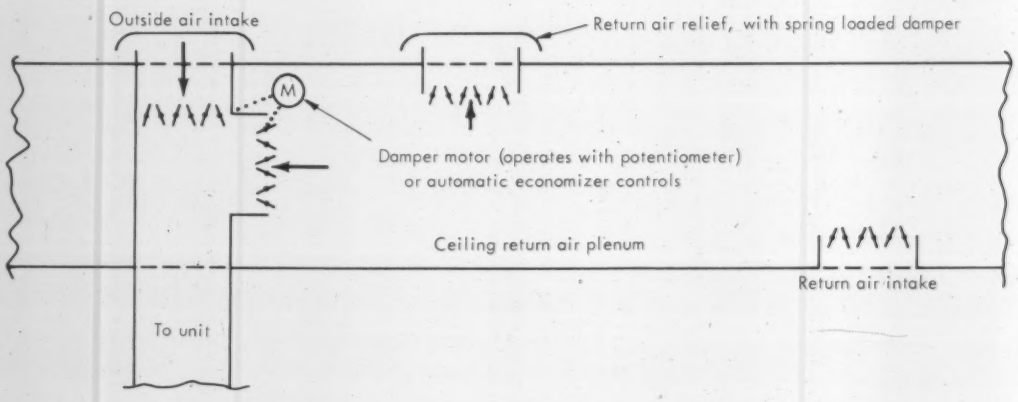
"Will a single fan system with variable outdoor air supply operate satisfactorily in a small commercial building? The diagram below is an example of such a system.

"I really would like general answers to this question since such systems may be applied on various types of buildings.

"I have recently designed such a system for a 25 unit suburban office building requiring 14 tons of air conditioning capacity and an air flow rate of 6000 cfm. An underfloor supply system was used and return air collected through 25 registers into a ceiling plenum. There were interior rooms (with skylights) which required heating in winter but cooling at noon. A variable outdoor air system was required to obtain an air temperature of 60 F when the cooling tower and compressor were shut down. There was neither space nor money for a return/exhaust air fan.

"I know that this system will work. The real question is just where can such a system be used and how large can it be.

"This system, operating at 0.80 in. S.P. normal, will have its air quantity reduced 6 percent when operating at 0.90 in. to pressurize the rooms. On a system operating at 2 in. S.P. total volume will decrease 3 percent to accommodate increased outdoor air."—P.J.B.



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...they're the only towers with a 20-Year Guarantee on the wetted deck surface!

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"After trying several makes, I standardized on H&M Cooling Towers. *The wood fill is specially treated with creosote applied under pressure*, and water plants and animals can't live on that! That's why the Halstead & Mitchell towers carry a 20-Year Guarantee on the wetted deck against failure due to fungus attack or rotting."

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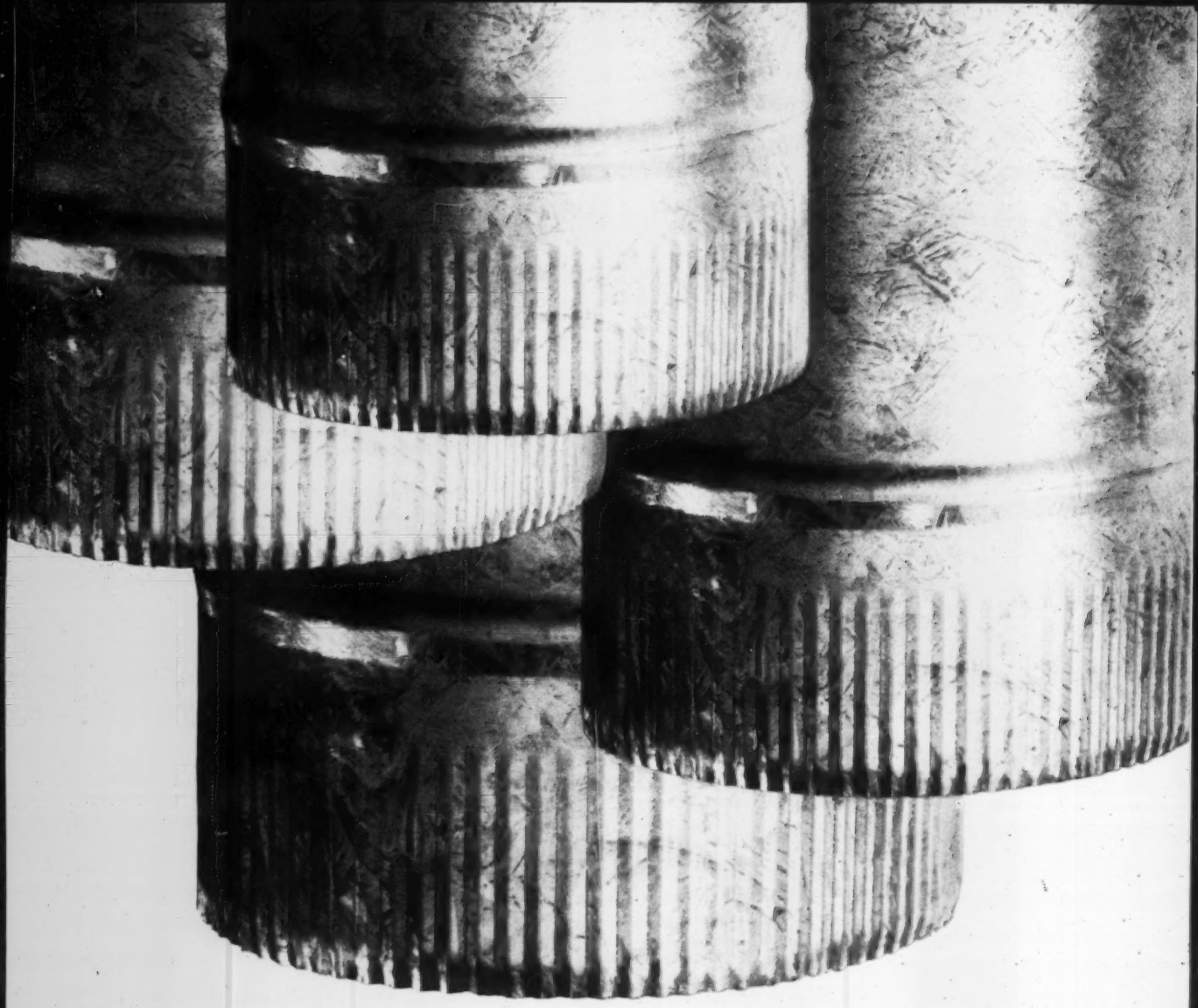

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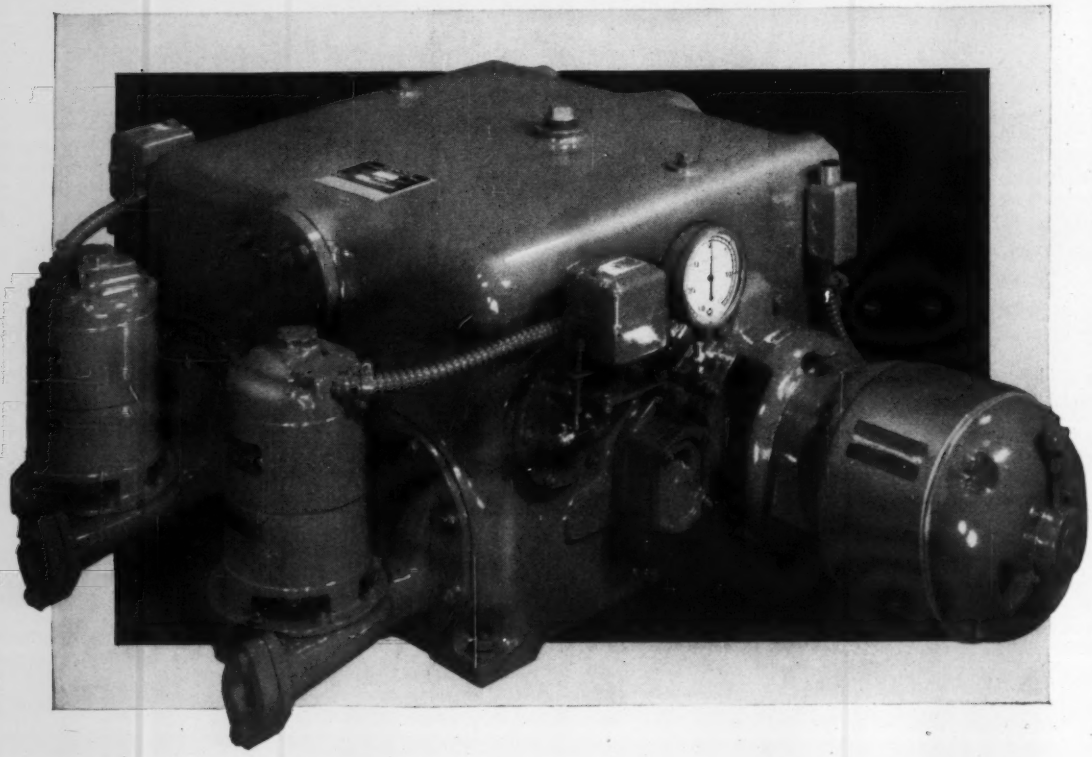
THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
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There is no lack of variety in the kinds and sizes of centrifugal pumps available today — either from stock or through special design services. Still misapplications occur. Systems fail to operate as expected, and as required.

Getting proper operation from a piping system, whether for year 'round air conditioning or for process work, requires first of all that all the components be properly selected as to size, material, and performance characteristics. Correct pump selection is critical. Here are the things the engineer must consider.

A Guide to Selecting Centrifugal Pumps

THE CENTRIFUGAL PUMP — there is probably no other piece of mechanical equipment so deceptively simple in construction and yet so complicated in application. Further, perhaps no other piece of equipment is made in so many styles and designs, a number of which are the result of evolutionary experience which has caused a departure from theoretical design rules.

This is a general guide to centrifugal pump selection, in which we shall set forth the ground rules of determining needed pump characteristics and equating these requirements with the kinds of equipment which are, or can be made, available. Therefore, performance figures which are used to illustrate certain points must be accepted as generalities, subject to considerable variation at the discretion of the designer to fit particular applications.

Cost Can Be Controlled

Pump manufacturers have their standard lines of stock centrifugal pumps, and in addition, can supply thousands of special designs to fit unusual applications. Unfortunately such special designs must be handled from the beginning on a, say, one or two unit basis. Since the economics of mass production are therefore lost, costs of such units will increase accordingly.

Occasionally, design conditions may be so severe that even if special designs and materials are used, pump life will be measured in months. At the other extreme, a well built standard pump may do a particular job for years with little or no attention. In any event, useful pump life will be directly related to the care with which any pump is selected to suit design conditions. And obviously it behooves the engineer to select a pump by means of a set, comprehensive plan which will consider all the variables.

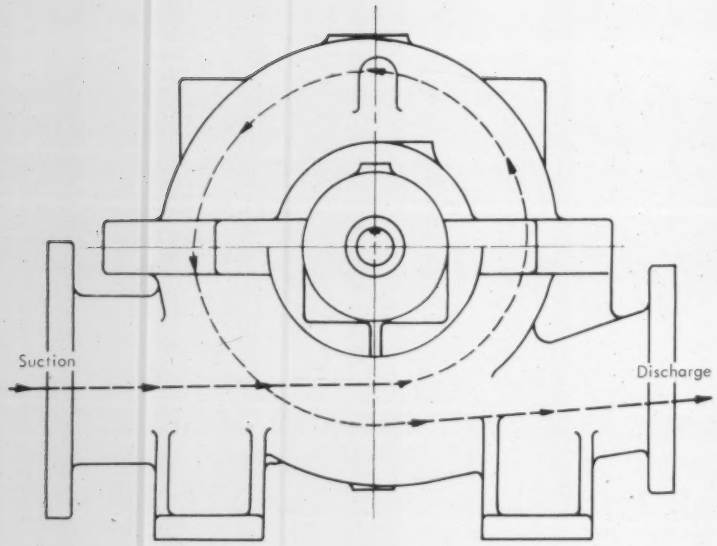
This article will deal with standard applications in the heating, piping, and air conditioning field, and covers most ordinary uses of centrifugal pumps.

Assuming that the capacity and head requirements have been determined, the next step is actual pump selection. What is involved?

Determining Pump Rotation

When a pump is to be installed as a replacement unit in an already existing installation, or when it is

By HAROLD W. WOODHOUSE
Stevens Institute of Technology



1 PUMP ROTATION is classified as either right or left hand. At left, view is *from* driver *to* pump, and particle moving through pump would follow broken line, counter-clockwise around shaft. Rotation is therefore "left hand"

to go into a new installation where the piping layout has already been decided, the locations of suction and discharge are fixed. With a double suction pump (and virtually all other centrifugal pump designs) this determines the direction of rotation.

Pump rotation is normally classified as *when looking from the driver toward the pump.* From this vantage point, clockwise rotation is called right hand, and counter-clockwise, left hand.

How Does Fluid Flow?

Fig. 1 shows an end view of a typical, single stage, double suction pump, with the suction connection on the left and the discharge on the right.

Determination of rotation is made by following the path of an imaginary particle of liquid through the pump. It will follow the dotted line as shown.

This flow particle, in traversing the suction and discharge volutes, will circle the shaft in a counter-clockwise direction. If this view is from the driver to the pump, then the rotation is left hand. Careful consideration of the information given regarding pump rotation in design data may frequently uncover errors and avoid expensive machining mistakes.

Approximating Pump Size

The required capacity determines the size of a pump — that is, whether a 2, 6, or 20 in. unit is needed. Pump size is designated by the diameter of the *discharge* opening. Usually, but not always, the suction opening is one or two sizes larger.

Regardless of what else the pump is called upon to do, it must have flow passages large enough to pass the required volume of liquid at a satisfactory velocity for the size of the pump and conditions under consideration. Therefore, capacity determines the size.

Allowable discharge velocity is greater for smaller pumps than for large ones.

Suction velocity is of particular importance in the case of large pumps which develop a low head and where there is no static head on the suction side. It is also important in condensate pump applications where the water is hot and there is little static suction head. Too great a suction velocity in such cases will result in cavitation.

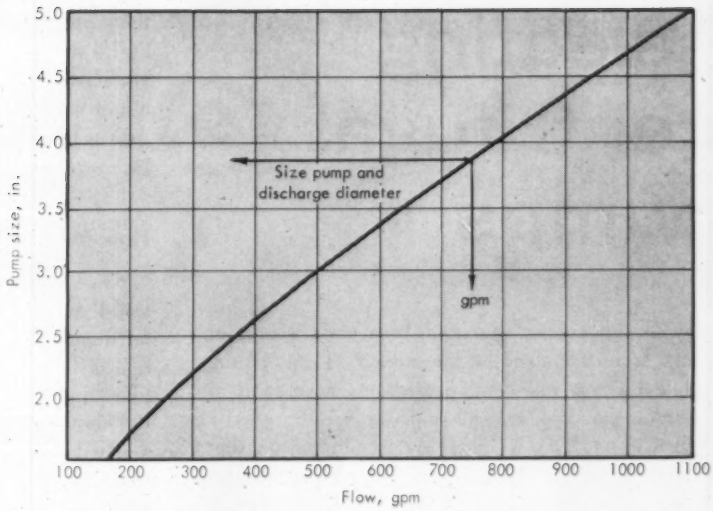
Curves Show General Range

Using some typical velocities, the curve of Fig. 2 has been plotted for small pumps, and that of Fig. 3 for larger units to show the approximate capacity which might be expected from a specific size. These curves do not rigidly fix pump size. A specific job might permit a smaller size or dictate a larger. These curves merely serve to keep us "in the ball park." One convenient point of reference is that 1000 gpm will require, roughly, a 5 in. pump.

Naturally, in using Figs. 2 or 3, one should select the nearest larger pump size available. Note also that there is a strong trend away from the use of certain pipe sizes, such as 1-¼, 3-½, 5, 7, and 9 in. lines.

The curves of Figs. 2 and 3 are based on discharge velocities, and, as noted, the discharge size normally fixes the pump size. There are, though, instances in which the liquid is highly volatile or of a high temperature, and if either or both of these conditions are coupled with a lack of head on the suction side, suction conditions may be so critical that a larger pump, or one with an oversize suction inlet and impeller eye, will be needed.

If the liquid to be pumped is particularly viscous, the pump will have to be selected with a larger capacity (based on water) to deliver the required amount of viscous fluid. Standards of the Hydraulic



2 PUMP SIZE is designated according to diameter of discharge opening. Pump capacity (flow) will determine what size passages will be needed. This graph shows *approximate* capacities which might be expected from some small pump sizes

Institute include correction factors to be applied to the water-capacity values in such cases.

Wheel Imparts Force

In a centrifugal pump, the only component which actually imparts energy to the liquid is the impeller. This energy, at the point of discharge of the impeller, is in the form of both kinetic and potential. Kinetic energy is represented by the velocity of discharge from the impeller and the potential energy by the static pressure.

Total Head Is "Constant"

Later, in passing through the casing volute or diffuser vanes, some of the kinetic energy will be converted to additional potential energy, but the total energy or total *dynamic head* is the "same" as when leaving the impeller. More precisely, the dynamic head will be slightly less because of some frictional and turbulence losses which will occur in the volute or diffuser.

How Pump Head Is Determined

The basic formula for pump head is derived from the velocity of a body (of any weight) falling from a specific height, as follows:

$$V = gt$$

and

$$H = gt^2/2$$

from which

$$V^2 = 2gH$$

or

$$V = \sqrt{2gH}$$

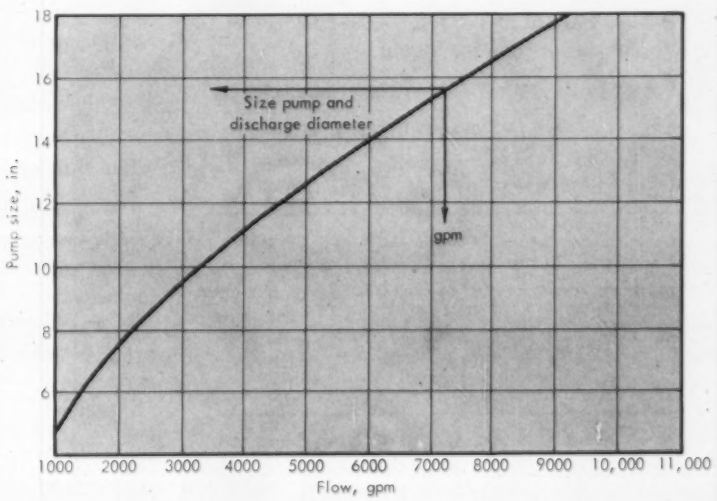
or

$$H = V^2/2g$$

where

t = time, seconds
V = final velocity after t seconds
g = acceleration due to gravity, 32.2 ft per sec^2
H = height in ft

These formulae are independent of the specific gravity of the liquid.



3 LARGE PUMP capacities will vary according to discharge opening diameters about as shown here. Designer would select next larger standard size to handle required flow

selecting centrifugal pumps

Since the energy imparted to a unit weight of liquid is independent of the weight of the liquid, then the pump will develop the same head in ft of the liquid handled, regardless of the specific gravity of the liquid. This is important. It also means that the same head-capacity curve, in ft, is valid regardless of the liquid handled. (Some exception will be made to this only if the liquid is quite viscous, *i.e.*, not "free flowing.")

Use "Ft of Liquid"

Head is expressed in various ways — ft of liquid, psi, or in. Hg. Other units should always be converted into ft of liquid handled.

The most common conversion is from psi into ft of liquid. The following are commonly used equations for such conversions:

$$\text{Head, ft} = \text{psi} \times 144/\text{density, lb per cu ft}$$

Water at 68 F weighs 62.4 lb per cu ft, so

$$\text{Head, ft} = \text{psi} \times 144/62.4 = 2.31 \times \text{psi}$$

From this it can be seen that a column of water 2.31 ft or 27.7 in. in height will exert a pressure of 1 psi.

This conversion equation may also be rewritten as

$$\text{Head, ft} = \text{Pressure, psig} \times 2.31/\text{specific gravity, liquid pumped}$$

In a similar manner, if the head is specified in in. Hg, it can be converted to ft of liquid by

$$\text{Head, ft} = \text{In. Hg} \times 1.134/\text{specific gravity, liquid pumped}$$

The effect of specific gravity is seen as follows, where it is assumed that in each instance a discharge pressure of 100 psig is required:

Substance	Specific gravity	Head required, ft
Water	1.0	231
Gasoline	0.75	308
Brine	1.20	193
Sulfur (liquid)	1.79	129

Since impeller diameter and peripheral speed are a function of

$$V = \sqrt{2gH}$$

the head generated at constant speed will vary according to the square of the impeller diameter. Impellers to deliver 100 psig of water, gasoline, brine, and liquid sulfur would be sized, then, for diameters to deliver heads of 231, 308, 193, and 129 ft, respectively.

How Many Stages?

Since head developed is related to impeller tip speed, and therefore also to the combination of impeller diameter and rpm, the next step is the determination of how many stages are required to do a particular job.

There will be no general answer to staging design, applicable to all conditions. One stage, with one large-diameter impeller, will not be as efficient as two or three stages with smaller impellers. This is because friction loss of the impeller discs rotating in the liquid increases according to the fifth power of the impeller diameter, while head increases only according to the square, or second power, of the diameter. Thus friction losses will rise at a much faster rate than will the head if, by increasing either impeller or tip speed, we try to get too much head from a single stage. This means that overall pump efficiency will decrease and the problem is resolved into another variation of the old struggle of low initial cost *vs* high efficiency.

Other Single-Stage Hazards

Certain other difficulties occur with too large an impeller. The pump may be noisy and vibrate. The impeller may be too narrow at the discharge for good castings to be made, and material strength may become a factor. It becomes difficult to clean the passages between vanes so that casting fins and bumps may be left to disturb the fluid flow.

The question of staging will be resolved on the basis of what types of pumps are available to suit a particular application. No one pump, and no generality on the number of stages needed, will cover every application.

When Suction Must Be Considered

The speed at which a pump can be run is frequently determined, or limited, by suction conditions. If such conditions dictate a low speed, it becomes impracticable to develop a high head per stage.

To avoid tying a multistage pump down to a slow speed because of suction conditions — thereby increasing the cost and number of stages required — a booster pump ahead of and in series with the main pump is often used. A booster pump operating at low speed and low liquid velocity at the impeller eye can function with a very low NPSH (Net Positive Suc-

tion Head — to be discussed later). The discharge from the booster to the main pump suction will then be at a pressure high enough to eliminate cavitation troubles resulting from too low an NPSH.

The approximate head, H, in ft, which an impeller of outside diameter D_2 in. and corresponding peripheral tip speed U_2 (fps) will develop at a particular speed N (rpm), is obtained from the relationship

$$D_2 = 1840\ \phi\sqrt{H/N}$$

where ϕ is a coefficient related to the particular pump design. It varies both above and below a value of 1.0. If we use an average value of 1.0, then the anticipated head available per stage for different impeller diameters rotating at standard electric motor speeds may be plotted as shown in Fig. 4. This should be used as an approximate guide only.

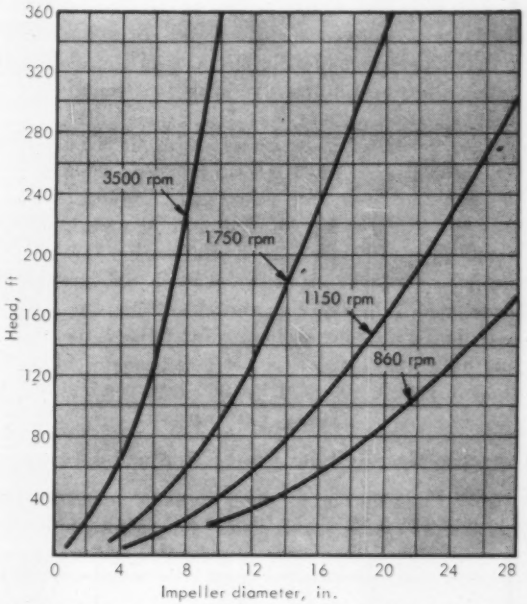
The equation above can also be written

$$U_2 = \phi\ (\sqrt{2g})\ (\sqrt{H})$$

Since standard commercial pumps use various iron or bronze cast impellers, tip speeds are generally held to a moderate figure. If we assume that where suction conditions are no problem, the tip speed is held to 150 fps, we can use the above equation to find that the corresponding head is 349 ft. This is illustrated in the plot of tip speed *vs* head in Fig. 5.

For certain high speed applications, the impeller tip speed may be considerably greater than 150 fps. 220 fps would not be excessive. The latter value would result in a head of about 750 ft per stage.

Again, these limitations must be used with caution, as they are not dependent upon some single, clearcut consideration.



4 HEAD AVAILABLE per stage for different impeller diameters rotating at standard electric motor speeds

Power Factors

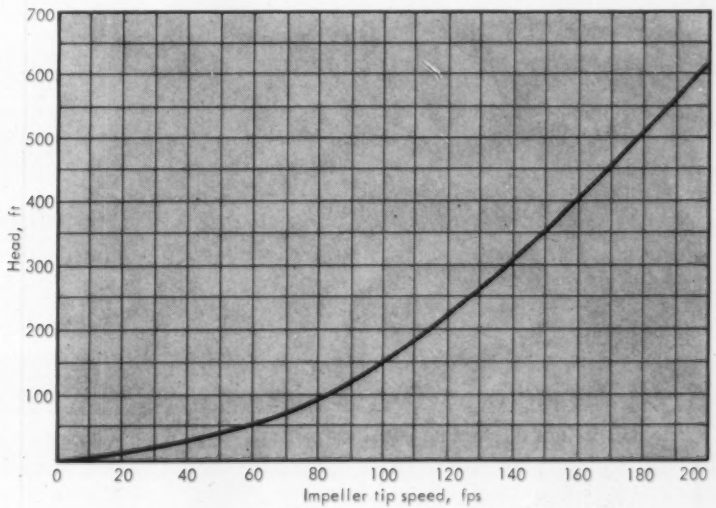
Water horsepower is the theoretical rate of work at which a pump must perform to deliver a constant quantity each interval of time against a stated head.

The quantity of liquid is usually designated in gpm, but could just as well be in lb per second or barrels per day. The term "water hp" is used, regardless of the actual liquid being handled, to express the power required at 100 percent efficiency.

If a weight, W, were to fall from a height, H, equal to 100 ft, then it would attain a velocity of

$$V = \sqrt{2gH}$$
$$= 80.3 \text{ fps}$$

To return weight W to its original height would require that it be projected upward with a velocity of 80.3 fps. To do this, an amount of work equal to $W \times H$ would be performed. A pump which per-



5 PUMP HEAD as function of tip speed plots as shown here. Tip speeds are usually kept to moderate values, but may go to 220 fps or higher for special applications

formed this work would be said to deliver 100 ft of head.

If this pump would deliver 1000 gpm of cool water to the 100 ft height, then the work done would equal

$$(1000)(8.33)(100) = 833{,}000 \text{ ft-lb per min}$$

where

8.33 = weight of 1 gal water with a specific gravity of 1.0

If the liquid were gasoline, then the work done would equal 1000 X 6.25 X 100 = 625,000 ft lb per min; where 6.25 is the weight of 1 gal of gasoline corresponding to a specific gravity of 0.75.

If the liquid were molten sulfur (14.9 lb per gal, specific gravity of 1.79) the work done would be 1000 X 14.9 X 100 = 1,149,000 ft lb per min.

Specific Gravity Sets Power Demand

It can be seen that to pump the same quantities of gasoline and water against the same heads, the gasoline would require only 75 percent as much work as would water. Molten sulfur would require 79 percent *more* work than water. This is to say that the work done in pumping a liquid is proportional to the specific gravity of a liquid, and, therefore, the specific gravity of the liquid will determine the power required to drive the pump (the work done).

How Liquid Weight Is Introduced

If, in the water hp equation, W represents the weight in lb of liquid delivered per unit time of 1 min, then the equation may be rewritten to express the theoretical, or water hp required by the pump as follows:

$$\text{Water hp} = WH/33{,}000$$

where

33,000 = ft-lb per min per hp

To deliver 1000 gpm against a 100 ft head, the three liquids used as our examples would require the following power:

Water — 25.2 hp
Gasoline — 18.9 hp
Molten sulfur — 45.1 hp

In these examples, it is seen that, for water, there is a constant:

$$8.33/33{,}000 = 1/3960$$

so that, for water of specific gravity 1.0, the equation can be written

$$\text{Water hp} = (\text{Gpm})(\text{head, ft})/3960$$

Provide For Specific Gravity

The unit weight of gasoline is 6.25 lb per gal, and its specific gravity equals 6.25/8.33 or 0.75. Its unit weight can be represented by (Weight of water) (Specific gravity). Therefore, to include liquids other than water, the water hp equation can be rewritten to provide allowance for specific gravity:

$$\text{Water hp} = (\text{Gpm})(\text{Head, ft})(\text{Specific gravity})/3960$$

This shows again that the water hp required by a pump is directly proportional to the specific gravity of the liquid pumped.

TABLE 1 — CONVERSION FACTORS listed here can be used to arrive at standard units for centrifugal pump sizing

	Equals
1 barrel	42 U.S. gal
1000 barrel per day	29.2 gpm
1 million gal per day	694.4 gpm
1 cu ft liquid	7.48 gal
1 cu ft per second	448.8 gpm
1 cu ft per min	0.1247 gal per sec
1 gal	0.1337 cu ft
	3785.0 cc
	231.0 cu in.
	0.003785 cu meters
	0.004951 cu yd
	3.785 liters
	58,310.0 grains
1 U.S. gal	8.3453 lb (at 39 F)
	0.8327 Imperial gal
1 Imperial gal	1.209 U.S. gal
	277.0 cu in.
1 gpm	0.002228 cu ft per sec
	0.06308 liters per sec
	8.0208 cu ft per hr
	6.0086 tons water per day
	1440.0 gal per day
1 ton water per day	0.1664 gpm
1 cu meter water	264.2 gal
1 cu yd water	202.0 gal
1 cu yd per min	3.367 gal per sec
1 lb water	0.1198 gal
	For heads and pressures
1 ft water	0.8826 in. Hg
	62.43 lb per sq ft
	0.4335 psi
1 psi	27.71 in. water at 62 F
	2.3077 ft water at 62 F
	2.036 in. Hg
1 atmosphere	29.921 in. Hg at 32 F
	760.0 mm Hg
	33.9 ft water
1 in. Hg	1.134 ft Water
1 in. water at 62 F	0.735 in. Hg at 62 F

When "PSI" Is Used

Sometimes the head is given in terms of psi. Previously we said that a pump will develop the same head in ft of liquid handled, regardless of its specific gravity:

$$\text{Head, ft} = (\text{psi})(144)/\text{Density, lb per cu ft}$$
$$= (\text{psi})(2.31)/\text{Specific gravity}$$

Substituting the value of head in ft in the water hp equation:

$$\text{Water hp} = [(\text{Gpm})\ (\text{psi})\ (2.31)/\text{Specific gravity}]\ [\text{Specific gravity}/3960]$$
$$= (\text{Gpm})(\text{psi})/1714$$

The important point about this equation is that it shows, if the head is stated in terms of pressure (psi) that the water hp is independent of the specific gravity of the liquid.

Next: Pump Efficiency

Since, for all machines, the efficiency is the ratio of the power required to do the work at 100 percent efficiency to that actually required because of inherent losses, we can say

$$\text{Pump efficiency} = \text{Water hp}/\text{Brake hp}$$

Therefore

$$\text{Brake hp} = (\text{Gpm})(\text{head, ft})(\text{Specific gravity})/(3960)(\text{Efficiency})$$
$$= (\text{Gpm})(\text{psi})/(1714)(\text{Efficiency})$$

Certain constants relating to the stated flow of a liquid, which can be useful in making the conversions indicated above, are itemized in Table 1.

The Effect of Viscosity

In terms of a water-pumping operation, it is necessary to increase both the capacity and the head values when selecting a pump to handle viscous fluid.

It is necessary, then, that the hp required to drive the pump at the specified head and capacity of the viscous fluid is going to be greater than if it was water, even if they have the same specific gravities. Overlooking this factor has resulted in pump installations which failed miserably to deliver the required head and capacity, and in seriously overloaded drivers.

A correction factor (such as published by the Hydraulic Institute) must be inserted in the pump brake hp equation whenever viscous fluid is to be moved. The equation becomes

$$\text{Brake hp} = (\text{Gpm})(\text{Specific gravity})(\text{Head, ft})/(3960)(\text{Efficiency}_{corr})$$

where

$$\text{Efficiency}_{corr} = (\text{Efficiency}_{water})(\text{Correction factor})$$

An important item to watch in this equation is that the capacity and head used are those for the viscous fluid, *not* the corrected water values. The corrected water values *are* used to select the pump size. +

Succeeding articles will investigate pump performance curves, the effects of speed changes and viscosity on those curves, and the subject of Net Positive Suction Head.

Cover photo of pump installation at Southdale shopping center, Minneapolis, courtesy Minneapolis-Honeywell Regulator Co.

Air Conditioning a Must For Polaris Submarines

ONE of America's mightiest deterrents to foreign aggressors—the Polaris submarine—demands air conditioning with an efficient air filtering system. Sensitive electronic equipment and a 100-man crew, such as is aboard the U.S.S. George Washington, must be protected from airborne particles of cigarette smoke, cooking grease, dust, and other impurities.

The central air conditioning system in the U.S.S. George Washington uses two vaneaxial fans in series as prime air movers, according to the Union Carbide Development Co. Air is drawn from the ship's compartments, filtered, chilled or heated and returned to the compartments. A 300 ton refrigeration plant supplies cooling.

CONTAINING more destructive power than all the bombs dropped by both sides in World War Two, the U.S.S. George Washington cruises under the sea in full air conditioned comfort

Engineer tells of the successful planning and installation methods which resulted in an efficient, attractive modernization job for a commercial structure — with a description of the various plans considered, final comparative cost estimates for three possible solutions, and comments on how the job was completed in minimum time without undue interruption of the tenant's routines.

Induction and Low Pressure Systems Modernize An Existing Office Building

By RICHARD P. GRAEF
Project Coordinator
Walter Kidde Constructors

LOGISTICS and economics can almost overshadow the engineering problems in air conditioning an existing building.

In a new structure, mechancial work can proceed at well defined rates, and space is provided in the original design for needed equipment. Planning for an existing building job must include not only the system design, but a method for installing equipment that won't put the occupants out of business during the conversion.

Except in the unlikely case where a building can be wholly or partially vacated, air conditioning equipment must be added with minimum disruption of daily routine — not an easy task when air ducts, water piping, coils, controls, and filters must be brought into working areas and all traces of the intrusion removed with plaster, paint, and specially designed enclosures.

All this must be accomplished at reasonable cost, even though many operations are performed at night for premium labor rates.

Whether the building is tenant or owner occupied, the air conditioning system should be installed without reducing the productivity of personnel or robbing the occupants of valuable space.

Faced with this kind of problem coupled with a short working period between heating seasons, Walter Kidde Constructors designed and installed the 650 ton capacity air conditioning system for the 10-story Firemen's Insurance Building in Newark at a cost of approximately $1300 per ton.

The greater part of the work could be performed only between the end of one heating season in mid-May and the beginning of the next in mid-September. Most of the dirt and confusion causing operations, such as drilling about 700 holes through the floors for pipes and ducts, had to be carried on at night so that operations would not interrupt the firm's normal work schedule. Following are some of the considerations, plans, and methods connected with the installation of this high pressure induction system.

Early Study Avoided Trouble

Since the building occupies the entire site, there was to be very little room for preparing and storing

BEFORE AND AFTER air conditioning was installed in Firemen's Insurance Building, Newark. Right, radiators have been removed from beneath windows, holes drilled for air ducts and water risers. Below, induction units are installed beneath windows, with all services hidden by metal enclosures around building columns

MECHANICAL CONTRACTOR, John E. Joyce, Inc., expedited installation of primary equipment on roof by hoisting whole trailer loads, plus trailer, to top of 10 story building

material. Personnel could not be relocated within the building. Only the top floor employee dining room — closed for other alterations at the time — and the roof offered space for equipment storage.

A mock-up of one office bay was set up to study piping connections, clearance and working room. All piping and ducts were prefabricated in the mechanical contractor's shop and shipped with matching parts to the site.

On the site, a previously analyzed work schedule directed the flow of material and workmen to each bay with all components cut to length and ready for installation.

How System Was Selected

Good installation procedures were important in restricting costs, but the major control over expense was realized in the planning and design of the installation itself. Six different systems were considered, and cost and functional comparisons were drafted.

Three basic criteria were established for judging the proposals. The system was to provide:

1) Satisfactory operation with good air distribution and temperature control.

2) Flexibility for changes in building partitioning and variations in personnel and equipment densities.

3) Minimum future obsolescence and maintenance.

Final Consideration on Three Systems

The above requirements, of course, are quite normal for the type of job to be done. In the final planning stages, three system designs seemed to offer the best possibilities:

1) High velocity induction system with perimeter supply, supplemented by low pressure air supply on each floor for interior offices and elevator lobby.

2) Fan-coil units around the perimeter, supplemented by high velocity ventilating air diffusers in the ceiling perimeter, plus a low pressure air supply on each floor for interior offices and elevator lobby.

3) Low velocity distribution through ceiling ducts supplied from air handling units on each floor.

All three systems would be supplied with chilled water from a central generating plant.

Compare Initial Cost Figures

Original estimates showed that the installed cost

for the induction system would be approximately 16 percent less than fan-coil costs and about 20 percent more than the low velocity system.

Of the total $1.5 million estimate for the induction system, slightly more than half would go for the actual mechanical equipment and work, with the remainder needed for building alterations to make room for the system.

Table Shows How Systems Compared

Table 1 is a complete comparison of costs for the three systems. All cost variation percentages are calculated on the basis of the net increase or decrease involved in a particular proposal viewed against the total cost of the induction system. That is, where the low velocity duct system is estimated to cost 20 percent less than the induction system, that saving is due, in part, to savings of 4 percent because of less plastering, and not to a 4 percent cut in plastering costs.

The largest variation — 4½ percent — was the saving offered by this reduced amount of plastering with the low velocity system. The other large saving promised by the low velocity system was one of 4 percent of the total due to the smaller amount of piping required and 2.8 percent made by keeping the 30 yr old radiator system.

Interestingly enough, most of the variation between the induction and low velocity systems was due not to differences in the cost of equipment but to the operations required to fit the systems into the building.

Variations between the costs for the induction vs fan-coil systems were due to more extensive acoustical treatment of the high velocity ventilation system, a more expensive air handling system, and additional electrical work required in bringing power to each of the fan-coil units.

Base Decision on Performance

Costs were important, as they always are, but the major consideration was centered on how well the system would perform and its adaptability to the existing building, with particular importance placed on appearance.

The following are the final conclusions drawn with regard to each of the proposals for this particular building.

Induction System

Induction units would be installed along the perimeter of the building where major heat gains and losses occur. Since the high velocity primary air ducts

TABLE 1 — COST COMPARISON of three systems finally considered, with cost of high velocity induction system taken as base (100 percent). Variations in second and third columns are therefore percent variations from cost of induction system design. Apparent discrepancies in "totals" are due to addition or subtraction of variations of less than 1 percent, indicated by asterisks. Blank spaces indicate no change from induction system cost

Operation required	Induction units	Fan-coil units	Low velocity ducts
	Percent of total system cost	Change in total, percent	Change in total, percent
1. Cutting and demolition	5.1	*	−3.0
2. Masonry and concrete	2.6	*	*
3. Plastering	7.1	*	−4.4
4. Acoustical	3.3	+.7	+1.2
5. Marble and ceramic tile	1.3		−1.1
6. Flooring, structural steel, roofing	2.6	*	*
7. Painting	0.6	*	*
8. Temporary work	3.6	*	*
9. Premium time on items 1, 2, and 8	6.1	*	−1.9
10. Refrigeration	11.6	*	−1.4
11. Air handling	25.1	+6.1	−2.1
12. Water piping	6.8	−1.1	−4.0
13. Hot water radiation	2.8	*	−2.8
14. Mechanical changes	0.7	*	*
15. Electrical	3.2	+1.9	*
16. Engineering	6.4		
17. Construction fee	4.1	*	−1.0
18. Contingency	6.9		
Total, percent	100	116	80

*Less than 1 percent

would supply only a small portion of the cooling for the space (the bulk coming from the secondary air being induced over the unit's coil) those ducts could be relatively small; 4 to 6 in. in diameter, and could be easily installed next to the outside wall along with the supply and return water lines. All those services could be concealed with factory made enclosures.

Each unit could be controlled either by a separate thermostat or in conjunction with several others. Between-season control would be good, since the units could be supplied with warm water and cooled air, or chilled water and warm air as needed for border-line conditions.

Chilled water equipment for the entire building and air handling units for the top five floors could be placed on the roof, with air handling equipment for the lower floors located in the basement.

Advantages Were Apparent

Thus we noted these major advantages for the induction system: good air distribution, automatic control with built-in zoning and adequate flexibility, and a large amount of building modernization because of the fact that radiators would be replaced with space saving units.

Regarding problems of installation, piping and ducts could be put in place during normal working hours, and since the major equipment items would be located either on the roof or in the basement, these too could be installed during the day without interfering with the occupant's routines.

Low Velocity Duct System

This system would require the occupants to surrender about 400 sq ft on each floor to house air handling units. The units themselves would need large louvered air intakes on each floor for outside air. Chilled water and steam, however, would be supplied from refrigeration equipment on the roof and from the existing boiler room.

One advantage would be the reduction in the amount of piping needed. Only one supply and return piping riser set would be required in contrast to the 37 separate vertical risers needed for the induction system. Fewer risers meant fewer holes cut through the floors and less patching afterwards.

However, the low velocity system would do little for appearance since it would require a large duct down the center of each ceiling plus the retention of the existing radiators. Air distribution was considered inadequate, since the long duct runs would not allow for good temperature control or zoning — the whole space would have to be treated alike except for the effect of dampers. We had also to face the problem of disrupting the building routine during the installation of the ducts in the middle of all work areas, plus the question of possible further interruptions for maintenance with major equipment located on every floor.

Fan-Coil System

Most of the advantages of the induction system we found could also be obtained with fan-coil units. In external appearance the two would be quite similar. However as mentioned earlier fan-coil units would require substantially more electrical work. Outside ventilation air would also have to be supplied. Two avenues were available: either a small opening in the exterior wall for each unit, or a separate duct system for ventilation air. The former would not do for this building. A separate air distribution system, though brought into each area as easily as in the case of the induction system, would require special noise attentuators at each outlet — and this equipment, we found, was designed into the induction units.

Other air conditioning systems which were considered, including single or dual duct high velocity systems, provided no particular advantages of either expense, loss of floor space, or incompatibility with the architectural features of the building.

From Plan to Installation

Once the induction system was selected, detailed studies were made of the existing heating boilers and available refrigeration equipment. Boilers and burners were found to be in good condition, and since the roof area was available for refrigeration equipment, a steam absorption chiller was selected. This could be installed without major structural alterations due to the absence of vibration, and in addition, the existing main steam riser could be used. The alternative of a centrifugal unit would have required additional heavy wiring and some structural changes, and if placed in the basement, the installation of two 12 in. condenser water lines to the roof cooling tower. Costs of the two refrigeration machines were comparable, but it was estimated that the steam absorption unit would save about $5,000 a year in operating expense since the existing steam plant would handle the load.

Result: Smooth Work Progress

The actual installation of the system was carried off with dispatch. The heating system was ready to operate by the beginning of the heating season, and the entire installation completed in 11 months.

In operation, the system has had no difficulty meeting the extreme zoning requirements during summer, winter, or between seasons. John E. Joyce Inc., was mechanical contractor for the project. ∓

U-bend Suction Line Eliminates Leaks from Misalignment

By D. G. POPPE
Plant Engineer
Uranium Reduction Co.

ONE PROBLEM that often plagues pump and pipe men is that of leakage, breakage, and poor pumping performance due to the misalignment of suction piping leading to the pump.

The reasons for misalignment are many, but the most common cause is careless installation. This can be corrected at the source by proper instruction and supervision, of course, and once misalignment is suspected, this ought to be investigated first, with a view toward at least preventing a repetition of faulty methods.

Another Cause: Settling

A more complicated but also common cause of misalignment occurs when settling of a connected tank or pump takes place. Sometimes it is possible to remedy this condition by replacing the suction pipe with suction hose. This cannot be done, though, if the fluid being pumped is either very hot or of a nature that is incompatible with rubber or other hose materials.

Acid Lines Break

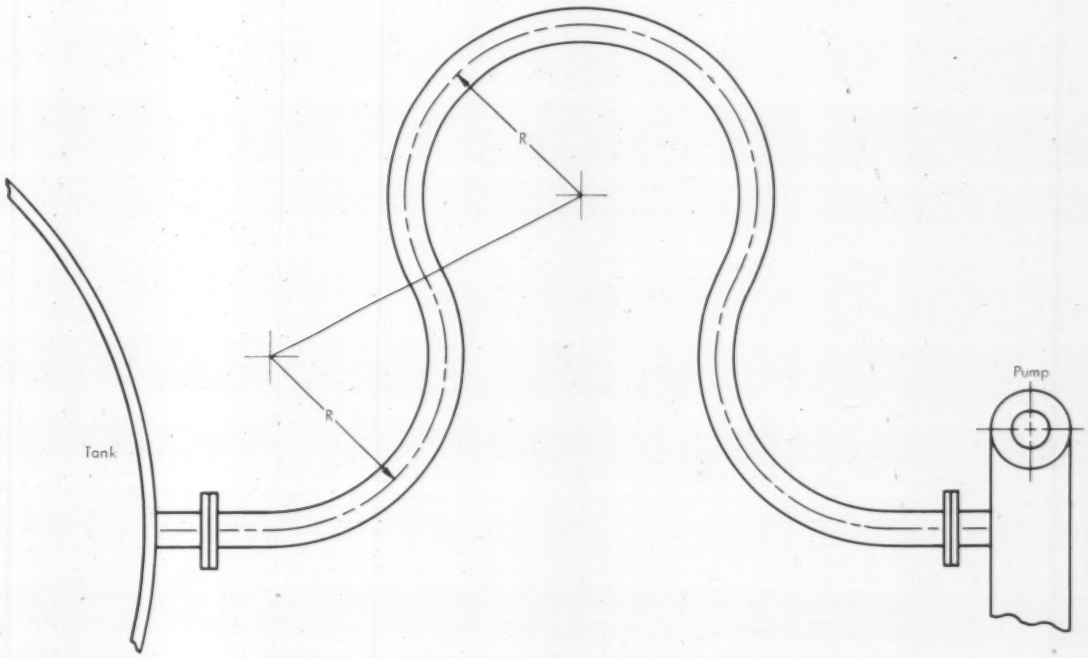
We experienced problems with our sulfuric acid pumps. Premature wearing and leaking prompted us to check the alignment of the system. We noted that leaks in piping some distance away from the pumps occurred very seldom, but repeated dangerous leaks developed where the suction pipe connected to the pump flanged casing on one end, and to the 20 ft diameter storage tank on the other. The leakage in turn caused the pump bases and brackets to corrode and collapse.

Other-than-metal suction hose, because we were pumping acid, promised extremely short life in service. The same limitation applied to the various kinds of expansion devices which were considered to correct the misalignment.

The Fig. illustrates the method finally selected for curing the problem. A double offset expansion U-bend was fabricated for each pump to radii as shown. We had previously used this idea on a steam piping system with good success, and have since made a similar application on two of our nitric acid tank pumping installations.

The sulfuric acid line has been in operation for several months with no further misalignment difficulties.

It should be noted that dimensions of such a U-bend will vary with temperature and stress experienced, and should be calculated. ≠

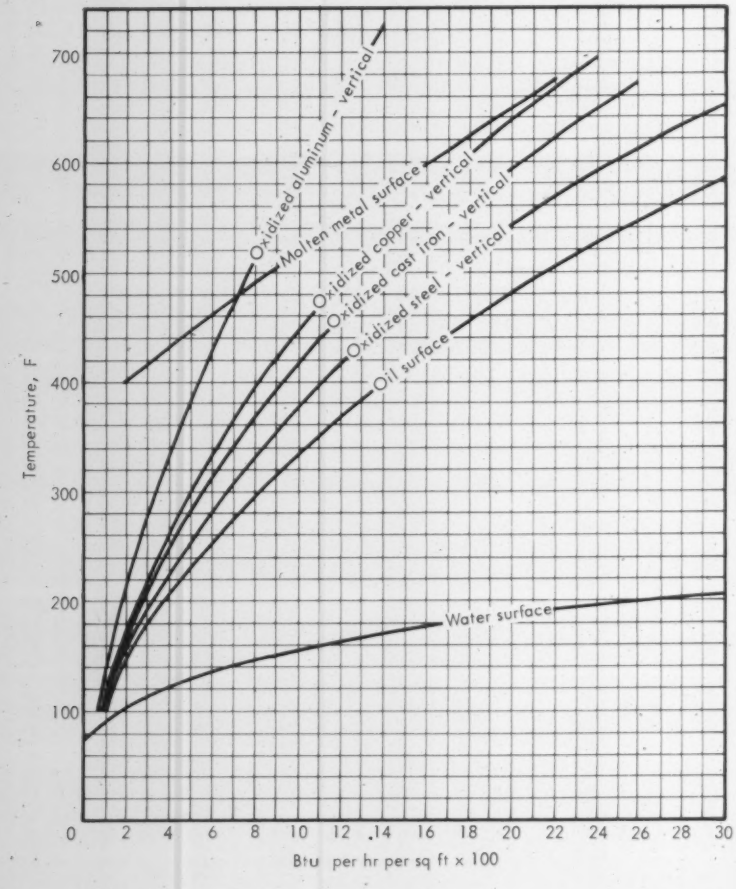


High temperature hot water systems are being increasingly accepted in the space heating field. It is time, says the author, for engineers to take the next step — the application of HTHW to the many different kinds of process requirements. The virtues he predicts for such systems are better control, greater flexibility, less danger of system contamination, and easier installation.

Here he tells what must be considered in designing HTHW process systems, and guides the reader through the procedures of proper coil selection.

How About HTHW For Industrial Process Work?

By ANTON KRAPEK
Professional Engineer



1 HEAT TRANSFER coefficients for various (uninsulated) tanks are a function not only of composition but of material temperature also. This is one of several factors to be considered in designing HTHW process systems

After a number of cautious years, high temperature hot water is finally coming into its own in the space heating field. Successful systems have been developed for a great variety of applications.

By and large, the basic components in such systems are quite similar, and can easily be adapted to other uses; or, in other words, to other heat transfer requirements. The HTHW field is still in relative infancy in the western hemisphere but concerted efforts on the part of our design engineers could develop this method of heat transfer into a practice as quickly acceptable as are steam and low temperature water today. The engineer should claim this project as his own, since he alone should assume the responsibility for the accomplishment of a good system.

Many equipment items are already available to cover a broader range of HTHW applications, or standard equipment can be efficiently modified to fulfill design requirements. Equipment manufacturers will comply with the wishes of the design engineers, as they have in the past.

A Natural for Process Work

Heat transfer, no matter what the medium, is applied similarly regardless of the particular problem. HTHW for space heating is growing, but process applications have not as yet been investigated to any great degree. Here is where HTHW[1] would adapt itself as though it belonged.

For instance, in plating processes where high pressure steam is used, condensate is almost necessarily wasted. Since various corrosive solutions are used in plating, returning condensate to the boiler opens the way to possible boiler damage. Steam gives up its pressure as it gives up its heat, so that condensate piping carries only atmospheric pressure. If a leak developed in the condensate piping within the solution container, the plating solution would enter the piping and continue on to the boiler.

The use of HTHW completely eliminates this problem. A closed system of coils and piping, under constant pressure, cannot possibly pick up contaminants. If a leak develops in the HTHW piping, water will leak into the solution tank rather than the other way 'round.

Further advantages of HTHW use for process work include more accurate temperature control and faster heat transfer. With steam, it is possible for stratification to occur across the length of the coil within the container during the warm-up period. Steam entering the coil condenses almost immediately on initial warm-up, so that it takes some time to fill the coil with steam along its entire length. With HTHW, flow through the coil is constant as regulated by the controls, and heat transfer equalized across the coil.

We will use the plating process application to illustrate this discussion. This does not exclude other processes, by any means. A little imagination and the same ideas can be applied to many other needs.

[1]Temperatures and pressures of hot water systems can actually be classified in three ranges: low temperature (180 to 250 F, 0 to 15 psig); medium temperature (250 to 300 F, 15 to 122 psig); and high temperature (300 to 400 F, 122 to 233 psig). Mr. Krapek chooses as his example a system using 300 F water, which could be classified as "medium" rather than "high" temperature. To avoid confusion, however, and because 300 F does not represent the upper temperature limit for process systems, HTHW is the better identification for the system described here.

Heat Transfer Considerations

Basically, the design of a HTHW process system follows common procedures. The ordinary concepts governing heat transfer have to be understood, and a number of factors considered.

If the unit to be heated is a tank containing process solution, the following must be obtained to determine the amount of solution heat required: tank volume when filled (converted to lb of water), the specific heat and specific gravity of the solution, and the required solution temperature rise. These values are inserted in the formula

$$Q_s = V(w)(c)(g_s)TD$$

where

Q_s = solution heat required, Btu per hr
V = tank volume, cu ft
w = weight per cu ft of water = 62.4 lb
c = specific heat of solution
g_s = specific gravity of solution
TD = temperature difference of solution, initial temperature to final temperature

What other factors enter into the design conditions? Obviously, while the solution is being brought up to final temperature the tank itself is working against this end. While the solution is being heated, it also is liberating heat through the sides, bottom, and top of the tank. If the tank has a closed top, it receives the same consideration as do the sides and bottom. If the top is open, and the solution exposed to the atmosphere, the heat liberated from the solution surface will be governed by the surrounding air conditions. Often a process tank must be furnished with induced ventilation to carry off fumes or odors. Sometimes tank surfaces must be insulated.

Heat Loss Through Tank and From Surface

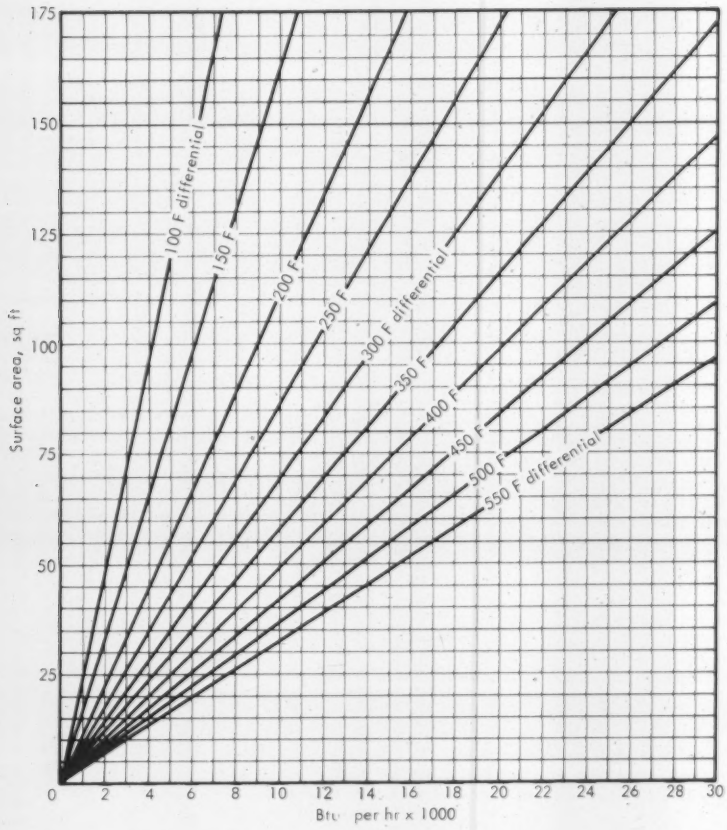
$$Qt = Ta(U)$$

where

Qt = tank surface losses, Btu per hr
Ta = tank area, sq ft, (sides and bottom, top open)
U = coefficient of heat transfer for tank material

The U factor for various materials can be easily determined by reference to Fig. 1, for uninsulated tanks, and Fig. 2 for insulated tanks. Note that the value of U is governed not only by the tank material but also by the temperature of the solution.

Heat losses sustained because of the exposed solu-



2 INSULATED TANK heat transfer coefficients vary, as shown here, in accordance with exposed surface area and temperature difference between high and low sides

tion surface are determined from a similar equation:

$$Q_{ta} = Sa(U)$$

where

Q_{ta} = surface heat loss, Btu per hr
Sa = surface area exposed to atmosphere, sq ft
U = surface heat transfer coefficient

Assuming that the solution has the same specific heat as water, the U factor might be obtained from Table 1. It can also be seen from this Table that forced ventilation over the surface of the solution has a marked effect upon the rate of heat transfer to the surrounding air. Specific heat values for any particular solution needed to arrive at the U factor for that solution will be available to the engineers involved in using it. Fig. 1 can also be used in determining this coefficient if certain conditions exist. This will be discussed in later paragraphs.

Processed Material Absorbs Heat

The final factor to be considered is the amount of heat absorbed by the processed material while it is immersed in the solution. It will be necessary to determine the specific weight and heat of the material, and the length of time it will be immersed. The first values will be inserted in the equation

$$Q_m = W(c)TD$$

where

Q_m = heat transfer, Btu per hr
W = weight of material, lb
c = specific heat of material
TD = temperature difference, F, solution to material

The amount of heat absorbed by the material will be directly proportional to the length of time for immersion. If the process is a dipping operation, the heat absorbed may be negligible.

Discount Effect of Very Light Matter

A similar consideration would be given to the weight of the material. If this is very slight, heat absorbed may again be negligible. This decision can be made at the time other calculations are made.

Engineers involved in a particular process project will have the characteristics of materials and solutions readily at hand, and can make an engineering judgment on the relative importance to be attached to the values of specific heat and specific gravity.

Example Shows Procedure

A simple example will serve as a review of the material covered thus far. Assume a steel tank 3 ft long by 2 ft wide will be filled with a 5 percent caustic solution (specific heat and weight the same as water) to a depth of 2 ft. The solution is to be heated to 200 F in an average space temperature of 60 F. No ventilation is required. The process involves repeated immersion of 100 lb of steel, causing agitation of the solution surface.

TABLE 1 — HEAT LOSS from water surface at various water temperatures and air velocities, for air temperature of 60 F, relative humidity of 70 percent

Water Temperature, F	Air velocity, fps: 0	0.5	1	2	5	10	20	50
	Heat loss, Btu per hr per sq ft							
60	7	18	21	26	34	56	95	180
70	33	52	60	78	105	170	270	580
80	78	110	125	150	210	315	510	1050
90	130	180	210	240	330	490	780	1600
100	205	270	320	350	480	710	1150	2300
110	290	370	420	480	670	1000	1600	3300
120	400	500	570	660	930	1350	2200	4400
130	550	660	750	890	1240	1800	3000	6000
140	710	870	970	1150	1600	2400	4000	8000
150	950	1130	1260	1510	2100	3200	5300	10500
160	1230	1450	1600	2000	2700	4050	6900	13700
170	1600	1900	2100	2600	3700	5200	9100	18500
180	2050	2600	2900	3550	5000	7200	12500	25000
190	2600	3550	4000	4950	6900	10300	17500	35000
200	3300	5200	5700	7000	9700	14600	25000	50000

Solution heat required:

$$Q_s = V(w)(c)(g_s)TD$$
$$= (12)(62.4)(1)(1)(140)$$
$$= 104{,}832 \text{ Btu per hr}$$

Tank surface loss:

$$Q_t = Ta(U)$$
$$= 26\ (330 - \text{From Fig. 1})$$
$$= 8580 \text{ Btu per hr}$$

Solution surface loss:

$$Q_{ss} = S_s(U)$$
$$= 6(3300 - \text{from Table 1})$$
$$= 19{,}800 \text{ Btu per hr}$$

Heat absorbed by material:

$$Q_m = W(c)TD$$
$$= 100(0.11)(140)$$
$$= 1540 \text{ Btu per hr}$$

Total load:

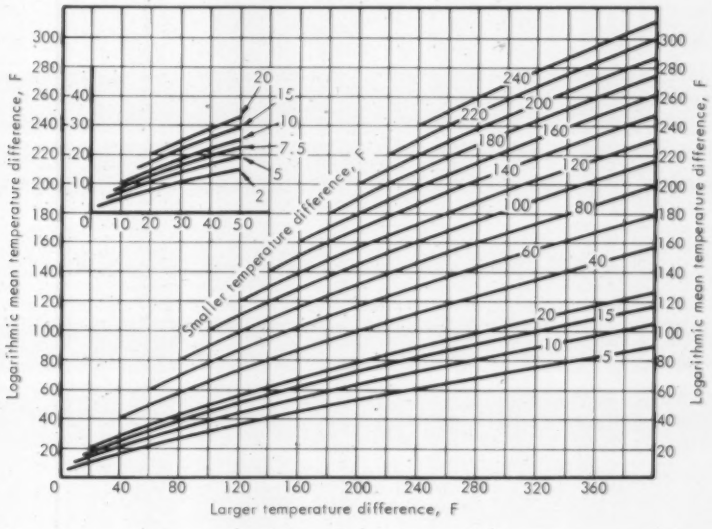
$$Q = 104{,}832 + 8580 + 19{,}800 + 1540$$
$$= 134{,}752 \text{ Btu per hr}$$

Since the solution heat load drops once temperature conditions are met, the load becomes a sustaining one only, and it can then be applied to the work load. In the example above, the work load (material) is so much smaller than the solution load that it can be ignored, since most work is not done until operating temperatures are reached. Therefore, we will consider a total load of 134,752 minus 1540 or 133,212 Btu per hr.

Note that the curve values of Fig. 1 do not correspond everywhere with the values given in Table 1. The curve values in Fig. 1 are for smooth surface water, while Table 1 covers agitated water. Thus the smooth surface yields a lower heat transfer coefficient. Table 1 values would occur where deliberate agitation is mechanically induced, where immersion is frequently repeated, or where the tank is mechanically ventilated.

Selection, Sizing of Coils

A number of manufacturers can supply a welded-



3 COIL SIZING will involve use of Logarithmic Mean Temperature Difference, heating to heated medium, which can be read directly from graph at right. Text explains use of graph and meaning of term

plate type of coil admirably suited to applications such as process work. Such a coil consists generally of two embossed mild steel plates welded together in a manner which provides a series of passes through which HTHW is circulated. Standard size inlet and outlet pipes are integrated into the coil.

Stainless steel or specially coated coils for highly corrosive processes are also available. Coils can be supported in the solution tank by slip-on hangers so that in case of difficulty they can be quickly replaced merely by breaking a pair of unions.

Surface Area Determines Size

The accepted way of designating coil size is by surface area. To determine how much area is needed for a specific load, the following equation is used:

$$A = Q/U(LMTD)$$

where

A = surface area required, sq ft
Q = total heat loss, Btu per hr
$LMTD$ = logarithmic mean temperature difference, F, heating to heated media

The value of U in this particular formula is dependent upon a number of variables. Coil area and time are of prime importance. The rate, U, of heat transfer through the coil wall equals the number of Btu per hr transmitted through each sq ft of coil surface per degree F. This rate of transfer will be governed by the type of solution being heated and its specific film resistance when in contact with the coil surface. Obviously an oil solution has a higher film resistance than does a watery solution, and an agitated solution would offer less resistance than a still one. Coil surface deposits retard heat transfer.

Coefficients for Various Solutions

Table 2 gives U values for various operating conditions. "Clean surface" coefficients should be used only when it is certain that the heated solution will produce no corrosion or fouling of the exterior coil surface. "Design coefficients" account for normal coil fouling with a reasonable safety factor. When heavy fouling is anticipated, the low side of the range should be used.

"Natural convection" coefficients would apply to tanks containing still solutions. If the temperature difference between the solution and the HTHW is quite extreme, the circulation rate around the coil is high, due to convection. In that case, use the high side of the range.

"Forced convection" values are for mechanically circulated tanks. All values apply to standard steel coils; when special plastic or lead coated coils are considered, the coefficient should be reduced by about 25 percent.

What Is "LMTD?"

A correct understanding of the "logarithmic mean temperature difference" is essential. Using our example problem, assume a HTHW inlet temperature of 300 F and a leaving temperature of 260 F (40 F drop). The solution is to be heated from 60 to 200 F. At the start of heating, the temperature difference available to "drive" the heat transfer equals 300 −60 or 240 F. As the solution gains heat toward 200 F, the HTHW loses heat towards 260 F, and when the terminal conditions are reached, the "drive" then equals 260 −200 or 60 F.

If the solution would experience a straight-line temperature increase an arithmetic average of starting and final temperatures could be used: (240 + 60)/2 = 150 F. However, this does not occur in heat transfer. Rather the increase, if graphed, would follow a curved line and a logarithmic calculation is necessary:

$$LMTD = (TD_1 - TD_2)/[\log_e(TD_1/TD_2)]$$

where

TD_1 = greater temperature difference, F
TD_2 = lesser temperature difference, F

TABLE 2 — AVERAGE HEAT TRANSFER COEFFICIENTS for various process-work solutions. U = Btu per hr per sq ft per F

	Clean surface coefficients		Design coefficients	
	Natural convection	Forced convection	Natural convection	Forced convection
HTHW heating applications				
Watery solutions	115 - 140	200 - 250	70 - 100	110 - 160
Light oils	50 - 70	110 - 140	40 - 45	60 - 110
Medium lube oil	40 - 60	110 - 130	35 - 40	50 - 110
No. 6 fuel oil	20 - 40	70 - 90	15 - 30	60 - 80
Asphalt	15 - 35	50 - 70	15 - 25	40 - 60
Molten paraffin	35 - 45	45 - 55	25 - 35	40 - 50
Corn syrup	20 - 40	70 - 90	15 - 30	60 - 80
Cold water cooling applications				
Watery solutions	110 - 135	195 - 245	65 - 95	105 - 155
Light oils	10 - 15	25 - 45	7 - 10	15 - 25
Medium lube oil	8 - 12	20 - 30	5 - 8	10 - 20
Corn syrup	7 - 10	18 - 26	4 - 7	8 - 15

To resolve the equation in the example problem:

$$LMTD = (240 - 60)/\log_e(240/60)$$
$$= 180/2.3 \log_{10}(4) = 130 \text{ F}$$

These calculations can become quite tedious when there are a number of coils to size. Fig. 3 allows a direct reading of *LMTD* values. Enter the graph at the larger temperature difference to the intersection with the lesser temperature difference. This intersection equals the *LMTD*.

Finally, Required Surface Area

Now to find the required surface area of the coil, we can insert the known values into the equation

$$A = Q/U(LMTD)$$
$$= 133{,}212/(130)(130)$$
$$= 7.88 \text{ sq ft}$$

Inspection of the various manufacturers' catalogs will enable the engineer to select a coil which will meet the area requirements. Coil pressure drops should also be checked. If too high, a single coil may be replaced with two smaller ones. Some other tips — for HTHW applications it is best to use coils with serpentine passes to provide for full flow, and coil dimensions should be such that easy removal and full immersion are assured.

Fitting the Coil to the System

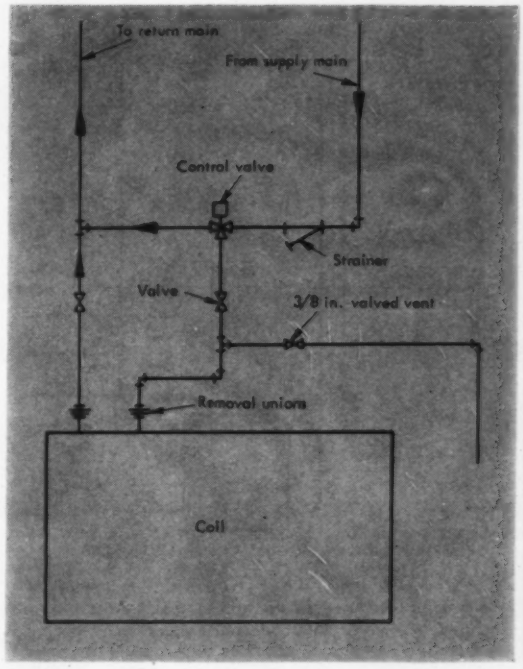
We won't attempt to cover here the design of the boiler room or main piping systems. Assume that a water tube boiler is used, along with water cooled circulating pumps and a system of nitrogen-charged distribution piping.

Piping for a single coil is illustrated in Fig. 4. Solution temperature control would be attained through the use of a 3-way bypass valve which would in turn be controlled by a thermal bulb immersed directly in the solution. Bulb location should be such that it will never touch the coil proper.

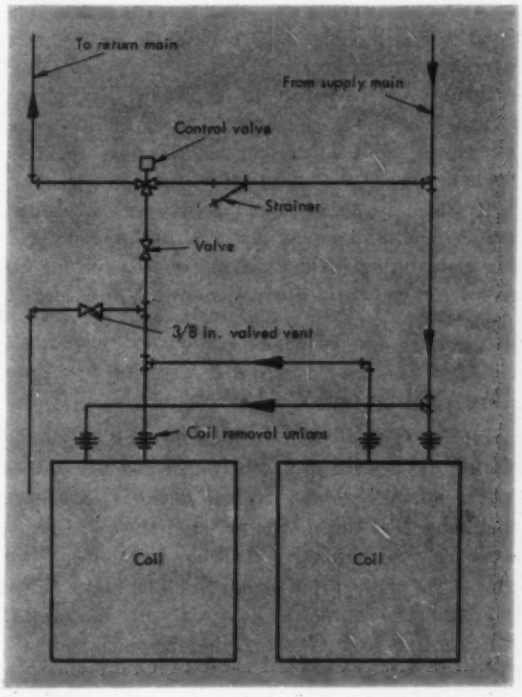
Fig. 5 shows the piping arrangement for a two-coil installation — used when single coil pressure drop would be too high, or where tank dimensions are restricted. The two coils could be placed on opposite sides of the tank, or they could be used in tandem. Two coils should provide better solution temperature control, since the transfer source will be distributed over a larger solution volume.

Same Coil Can Also Cool

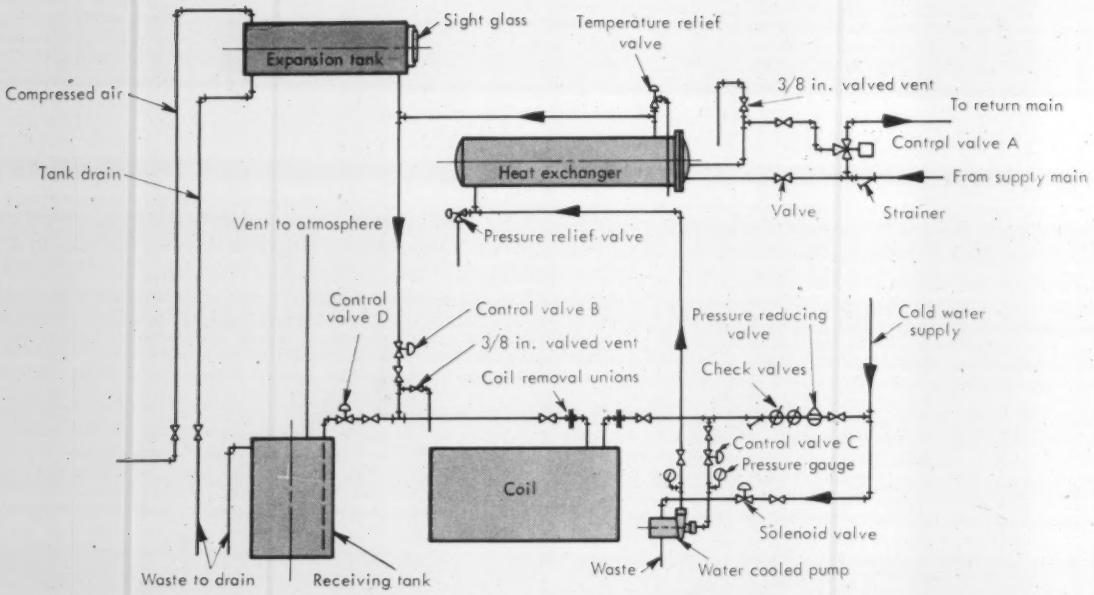
Some plating processes require the use of electric induction as soon as work is begun. Prior to immersion of the material, the solution temperature must be up to a specified value. As soon as processing begins, however, the heat liberated by electric induction starts to raise the solution temperature beyond allowable limits, causing the solution to lose efficiency or



4 SINGLE COIL in process tank can be piped as shown here. Solution temperature is controlled by three-way valve, with bulb directly in solution but not touching coil



5 DOUBLE COIL assembly shown here can be used when single coil would produce too high a pressure drop or when tank dimensions restrict coil size. Two coils could be placed on opposite sides of process tank, or could be used in tandem. Double coil arrangement generally will provide better temperature control due to greater solution-coil surface contact



6 ONE COIL HEATING-COOLING is illustrated above, with HTHW for heating, domestic water for cooling. Such a system might be used in plating process, where solution temperature must be raised prior to operation, but where heat liberated by electric induction must be removed during process. Flow through coil is reversed for two cycles

to break down altogether.

In such a case, it is necessary to utilize the same coil for cooling the solution. Domestic cold water can be used as the cooling medium, or if the load will be great, a water chiller may have to be incorporated into the system. At any rate, a water-to-water heat exchanger will be needed to keep the HTHW piping system closed. Fig. 6 shows a domestic water arrangement to which various modifications could be made as needed for a particular job.

It should be pointed out that the same equations, graphs, and tables apply to coil sizing for both cooling and heating. Table 2 includes U factors for use in solving coil surface equations in cooling applications.

How Dual System Works

In Fig. 6, valve A is open to the heat exchanger during the heating cycle, the pump and its solenoid valves are in operation, valves B and C are open, and valve D is closed. Supply water travels from the exchanger through valve B, enters the left coil line and leaves through the right. The dual check valves prevent entrance into the domestic water line so that flow must go through valve C into the pump and back to the exchanger. When heat is no longer required, valve A bypasses the HTHW supply to the exchanger. When a predetermined solution temperature is reached and cooling is required, the pump stops and its solenoid valve closes. Valves B and C close and valve D opens. Water flow through the coil now reverses, flowing from the cold water supply, through the dual check valves, into the right coil line and out the left.

Changeover Provisions

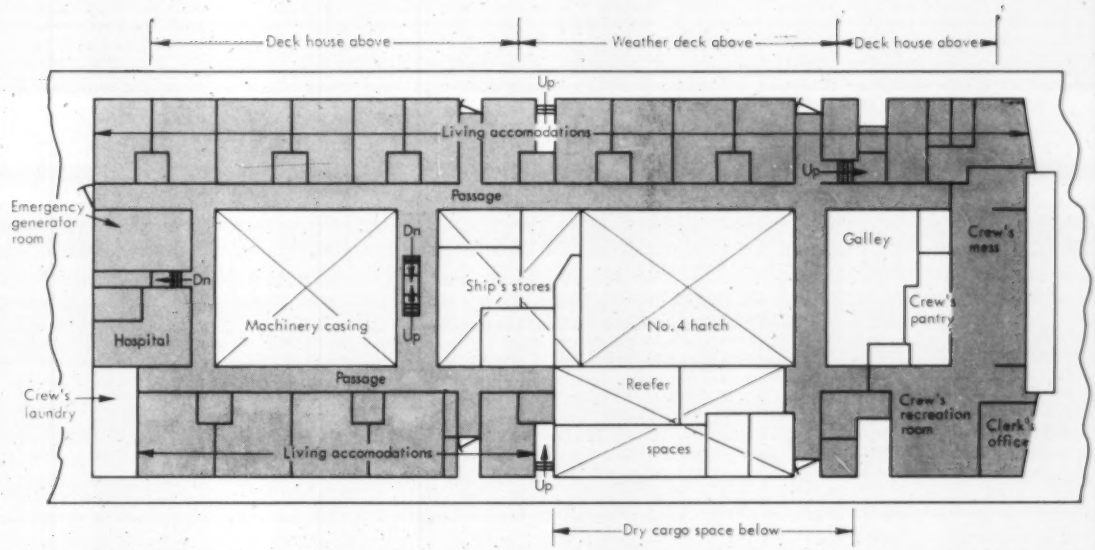
Since the domestic water piping is at a higher pressure than the heating line, the former also serves as a make-up line for the system. The entire coil must be evacuated at the start of the cooling cycle. Hot water is pushed out by cold. To prevent excess heat and vapor, it is best to provide a receiving tank which is vented to the atmosphere.

After the cooling cycle is completed, the tank remains full of cold water ready to reduce the temperature of the next charge. When the expansion tank becomes water logged, it must be emptied. This can be done by gravity flow; however, a compressed air line connected as shown and turned on after the drain line is opened will accomplish the emptying operation very rapidly.

Conclusion: Consider HTHW Carefully

HTHW can in fact be applied to any number of process variations. Though coils are generally installed within solution tanks, this is not a design criteria. Exterior applications can be made if the same care is exercised in calculating. A vast field is open to engineers who have the foresight to use HTHW to best advantage.

The author wishes to express his gratitude to Tranter Mfg., Inc., for their cooperation in supplying tabular data for this article. ∓



1 LIVING ACCOMMODATIONS aboard number of new Lykes Bros. Steamship Co. dry cargo vessels look like this. Gray areas are air conditioned by combination of induction and conventional air systems. Air conditioning main service lines are confined almost entirely to fore and aft passage — an important space saving feature

Air Conditioning For Cargo Vessels

By JOHN W. MARKERT
Supervisor, Heating, Ventilation and Air Conditioning
Gibbs & Cox, Inc.
Naval Architects & Marine Engineers

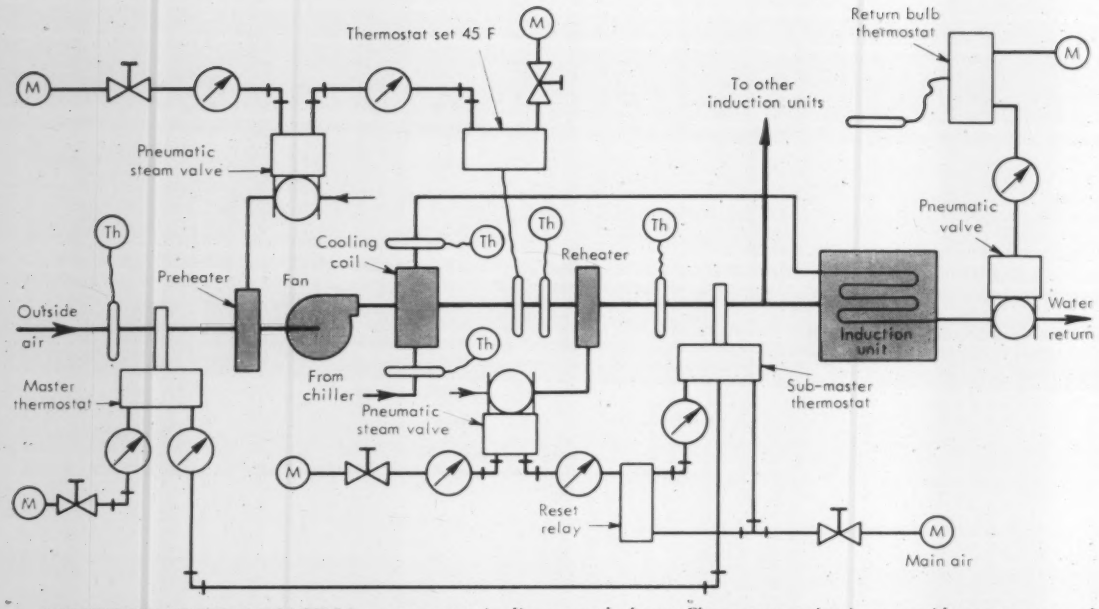
● **Comfort air conditioning for personnel quarters on a new series of dry cargo ships combines an induction system with a conventional preheat and reheat air system to serve the various use areas, including passenger staterooms, dining space, and a crew's lounge. These are the first induction systems to be installed in U.S.-built cargo ships, and the vessels themselves are the first for which air conditioning was included in the original design plans. This article describes the selection and development of units and prefabricated ducts — with some interesting sidelights on problems encountered in sea-going engineering.**

SEVERAL firsts are connected with the comfort air conditioning work for a number of new cargo ships being built for the Lykes Bros. Steamship Co. These are the first dry cargo vessels built in the United States with comfort air conditioning included in the original design. They are also the first cargo ships built here using induction air conditioning systems. Also, prefabricated spiral wound sheet metal ducts and fittings are being used for the first time.

Condition by Use Areas

Fig. 1 shows a typical accommodation layout for one of the vessels. Air conditioning is accomplished in the personnel spaces by means of an induction system which serves all spaces save the dining room, lounge, and crew's mess and recreation room — these being conditioned by means of a conventional air system with pre and reheat coils in the ducts.

As shown in Fig. 1, the accommodations are di-



2 INDUCTION SYSTEM CONTROL arrangement is diagrammed above. Changeover point is at outside temperature of 35 F. Constant water temperature of 140 F is used for entire heating range of 35 F to zero

vided into two "islands" connected by an interior passage. With minor exceptions, the air conditioning services running fore and aft are confined to this main deck passage area. Use of an induction system permitted a very compact space arrangement, with only an 8 in. diameter duct plus steam and water pipes required on this level. As noted above, the larger spaces are served by a conventional system to allow more latitude in the introduction of outside air except during very hot or very cold weather.

Simplify Control Method

The induction system is designed for a changeover point (cooling to heating) of 35 F. Fig. 2 indicates the control arrangement for the system. Originally, it was planned to control hot water temperature by means of a master-submaster thermostat arrangement operating in accordance with variations in outside temperature. However, calculations showed that a water temperature range of only 130 to 140 F was necessary to handle outdoor temperatures of from 35 F to zero, and consequently control was simplified to provide a constant water temperature of 140 F during the entire heating cycle.

Blow-Through Design Aids Efficiency

As shown in Fig. 2, a blow-through cooling coil design is utilized for efficiency. Since the coil follows the fan, instead of the reverse, fan heat is absorbed and a much lower primary air temperature is available. This increases the primary air cooling effect with the result that load on the induction units is reduced. This allows smaller units to be used in many areas as a space-saving feature.

Because secondary loads were thus reduced, primary air requirements are less, and the required refrigeration capacity is also lessened. The overall gain by this means was a reduction in system size by over 20 percent. It should be noted that recirculation of air was originally prohibited in the system design plans.

How Plans Proceeded

Load calculations to determine the primary air and induction unit requirements, reheater water temperature schedule, hot water temperatures and the proper changeover point involved consideration of the following factors for each conditioned space:

1) Maximum summer cooling (cool primary air and cool secondary water)

2) Intermediate cooling for an outside temperature of 70 F dry bulb (70 F primary air and cool secondary water)

3) Intermediate cooling at changeover when outside temperature reached 35 F (hot primary air and cool secondary water)

4) Intermediate heating at changeover (cool pri-

shipboard air conditioning

mary air and hot secondary water)

5) Maximum winter heating (cool primary air and hot secondary water).

Changeover Effects Good Balance

The 35 F changeover point was selected as a result of balancing all considerations for the expected operating conditions. Originally, a somewhat higher temperature was considered, but this would have involved the use of more primary air and in some cases larger induction units. A lower changeover point, on the other hand, would have required more nearly continuous operation of the refrigeration plant, and additional complications from the freezing possibility.

The induction units themselves are a specially designed wall-hung type with a sloping top. Several advantages were apparent with this type of installation. First, all equipment, including automatic controls, coil air vents, service valves, nozzles, coils, filters and strainers, and air balancing valves are easily accessible for inspection and service. Ceiling distribution, which can be costly in ship construction, was avoided. Space allocation could be "jelled" in the design stage, since the units could be located for minimum interference with quarters arrangements and headroom. Finally, return bulb type thermostats, with their close coupling between thermostat and controlled valve, could be used.

Develop Special Terminal Units

A very careful study of the enclosure design was accomplished prior to a decision on the shape and panel arrangement for the cabinets. For instance, the owner specified a sloping top to avoid having the units used as shelves. This study enabled a standardization on three sizes of upfeed, left and right hand units. Modifications for a few down feed and side feed units were made in the field.

Also, the same care was used in designing the facility arrangement within the cabinets. Induction unit coils have seven fins per in., and were tin dipped after the attachment of side sheets, top and bottom seals, return bends, supply and return couplings, and air vent connections.

A hinged section on the discharge grille provides access to the thermostat knob and air vent, and a second hinged grille on the front of the enclosure (for return air) opens for access to valves, lint screen, coil, and nozzles. Cellular plastic insulation is used on the piping within the cabinets.

Piping Handles Ship Roll

Piping from the induction unit drain pans is designed to clear condensate when the ship has a 15 deg trim or list. All condensate piping is trapped and terminates either over a deck drain, in a shower, or in a few cases on the open deck.

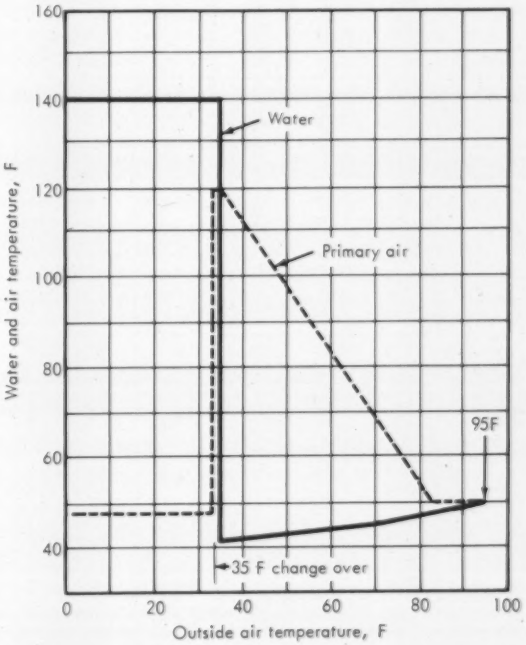
Supply water system is a reverse return, self balancing layout with hygroscopic air vents installed at the induction units where high points are encountered. Other high points in the system are provided with automatic float air vents. The system handles 120 gpm, and has a standby pump sized for 100 percent capacity.

Prefabrication Saves Time, Cost

All ducts between the reheater and the induction units were prefabricated, as were the fittings. Elbows are of the stamped, two-piece type. Tees and crosses larger than 5 in. are conical to minimize noise and pressure loss. In the past, high pressure ducts and fittings were fabricated by the shipyard of 16 gage galvanized metal, with welded shop joints and bolted angle flange field joints. Prefabricated construction will save about 50 percent in weight, plus considerable installation cost.

Full Testing Is Accomplished

Ducts are tested for tightness by a leakage rate test. Where necessary, testing is done by sections to expedite the subsequent application of insulation, lagging, vapor sealing, and the installation of joiner work. Flexible air connections are tested with the ducts, the end which will be attached to the induction unit being capped during the test run. ⌗



3 TEMPERATURE PLOT for water and primary air services to induction system is shown above

Low Volume, High Velocity System Controls Dust "At Source"

By J. L. BURGESS
General Manager
Dustuctor Co., Ltd.
Camborne, England

DUST is a by-product of some of our oldest industries. Since the introduction of powered tools and increased knowledge of the harmful effects of dust to the lungs, great efforts have been made to control manufacturing processes to either eliminate dust or to reduce the incidence below the harmful level.

The methods by which this may be accomplished are natural ventilation, forced extraction, or dilution of the working atmosphere by forced ventilation. Natural ventilation is particularly effective where the work involves the production of heat, causing convection currents which sweep dust and fumes into a flue.

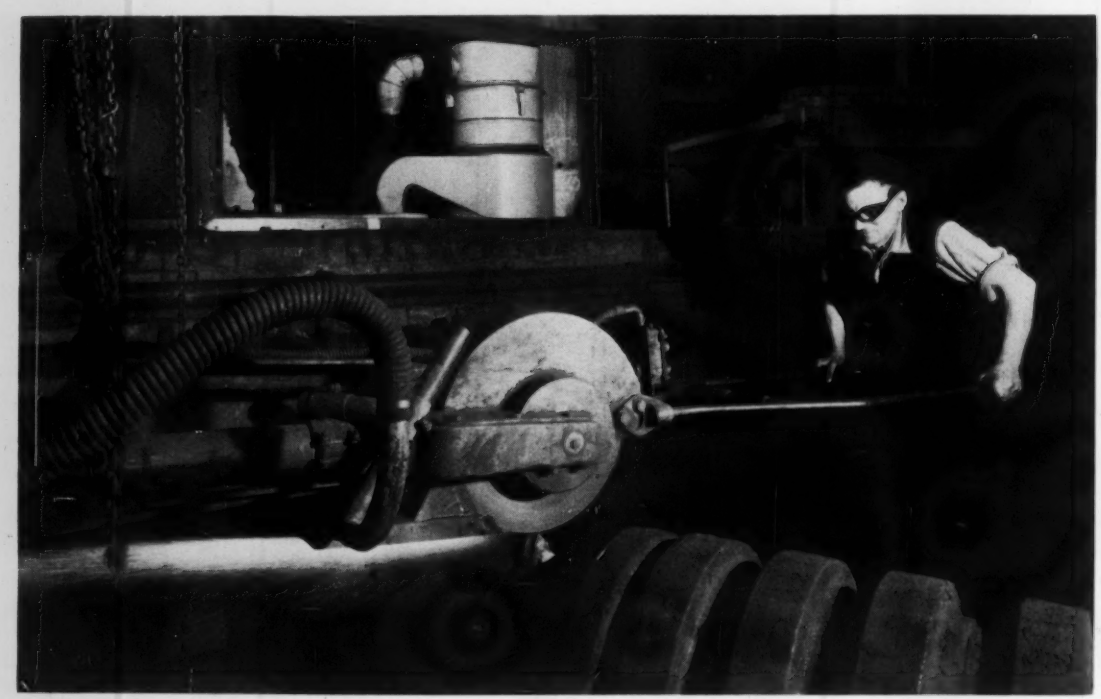
Where natural draft is not available, other methods must be used, but in all cases the objective is to draw the dust away from the operator so that he breathes "clean" air, or air having a relatively low dust content.

The increase of mechanization and faster industrial processes have not only increased the dust hazard but made the difficulties in dust collection greater. While general ventilation methods have been able to control process dust generated over a wide area, such methods are not suitable for use on portable tools such as high speed grinding wheels where the concentration is relatively local.

Government Studied Problem

Immediately following World War II the British Government appointed a special committee to study working conditions connected with an alarming increase in the number of silicosis and pneumoconiosis cases in the foundry industry. The committee report became known as the "Garrett Report,"[1] and attributed the increase in lung diseases to both the abnor-

[1]*See References at end of Article*



SWING FRAME GRINDER at Midland Rollmakers, Ltd., plant has low volume, high velocity dust extractor. Note collector tank in background

mal conditions of wartime labor and the increase of mechanization in the industry, plus the advent of higher pouring temperatures in steel alloy casting.

The Garrett Report made recommendations for the modification of certain processes to avoid or minimize dust production, and included an investigation of large casting cleaning work where portable chippers and grinders were used both inside and outside the casting. Here normal ventilation methods could not extract the dust effectively.

Recommend New Approach

The Garrett Report then recommended that if process modification failed to solve the dust problem, the dust should be controlled, if possible, "at source," before it escaped to the general atmosphere.

Early experimental work with a portable pneumatic chisel employed a method used earlier for a dustless rock drill when water injection was not desireable. The fettling hammer was constructed with an axial duct in the chisel, from which small branch ducts led to each side of the cutting edge. An axial tube through the hammer was connected to a compressed air Venturi dust extractor. Some success was attained by using a suction of 15 in. Hg, but it appeared that the special tool would be expensive to manufacture, and the small diameter ducts through the chisel became easily choked with dust.

Modification Improves Performance

This system was later modified to an external molded rubber sleeve fitting over the chisel, secured in place by a special clip. Such a sleeve proved workable with a suction of only 5 in. Hg, and the larger air passages were less susceptible to choking.

Preliminary work was also carried out on a radial hand grinder using grinding wheels of 6 in. diameter and 1 in. wide — a standard tool in many of the foundry shops. A peripheral duct fitted to the wheel safety guard contained a number of ducts through which dust was extracted. Later, a flexible roller was fitted which acted as a baffle, slowing down the stream of dust particles so that the fine dust could be "captured."

Need New Counting Methods

The search for a satisfactory method for controlling the dust produced by hand held power tools also made it necessary to find simple and effective means for comparing the efficiency of various dust control devices. Atmospheric dust particle counting techniques were well established, of course, and naturally instruments such as the konimeter, thermal precipitator, jet dust counter, and midget impinger were used in early experiments.

It was soon discovered, however, that such instruments were slow to use for this purpose, and more serious, gave very conflicting results. The foundry atmosphere would already contain a large number of dust particles from other processes, and besides, air currents carried clouds of dust sometimes toward the instruments and sometimes away from them.

Use Tyndall Beam

Particles most injurious to health are between 0.5 and 5 microns in diameter, which means they cannot be seen under ordinary lighting conditions. In order to observe the movements of such particles, then, use was made of the "Tyndall Effect." The phenomenon of the Tyndall Beam is familiar, and by its use particle movement which cannot be seen under normal lighting conditions can be observed.

A number of experiments in a dark room indicated that a 2000 w photographic spot lamp would be ideal for the purpose.[2]

When dust particle movement was studied by this method, the failure of the standard instruments to give consistent readings was understandable. Dust clouds from portable tools have sharply defined boundaries, so that a very small movement of the measuring instrument could make an enormous difference in the count obtained.

A spot lamp of less intensity and greater portability can be used to observe dust movement in similar locations. One or two 2000 w lamps will allow the

BEFORE, radial grinder frees quantity of cast iron dust

AFTER grinder is fitted with small extractor head for dust removal

observer to record by cinematography — a rapid and sensitive method for assessing the sensitivity of various dust control devices.

Find Practical Difficulties

Early work showed that dust control "at source" for portable tools was possible, but a series of working trials revealed a number of practical difficulties.

The original cowls on radial grinders covered 75 percent of the periphery of the wheel. In confined spaces, such a cowling made it impossible at times to place the wheel to the work. A cowl of smaller dimensions which would be adjustable to maintain the proper gap between the cowl and grinding wheel of decreasing size was needed. Successful development of small cowls for radial and cup type grinders, flexible disc sanders, conical and bullet-shaped grinding wheels, and other specialized tools followed.

For effective dust control, an extraction velocity greater than the velocity of the dust particles leaving the grinder had to be attained. Eventual port velocities varied from between 7,000 and 15,000 ft per minute. The design, size, and position of extraction ports was also critical, since certain operations tended to quickly clog the openings. A variety of solutions were found, including spark arrestors to prevent clogging by molten metal particles, and deflectors to exclude larger particles while the harmful dust was captured.

Reduce Vacuum Requirements

For the very early devices a suction of 15 in. Hg was used, but this was difficult to obtain with most exhaust equipment then in use. Good results were obtained by using a suction standardized at 5 in. Hg, which still allowed reasonably small diameter extraction hoses to obtain the extraction rates necessary for each tool.

The extraction rates which have been found to be satisfactory are as follows:

Pneumatic chisels	10 cfm
Mounted points and small cone grinders	25 cfm
Radial grinders (wheels 4 to 6 in. diameter)	37.5 cfm
Angle grinders and flexible disc sanders	75 cfm
Swing frame grinders	250-300 cfm

These extraction rates are very low by comparison with those required by other systems. For example, a swing frame grinder requires 6,000 to 8,000 cfm if dust is controlled by use of a booth-type enclosure. On the other hand, extraction *velocities* used with the new system are very high compared with booth and side draft systems — 7,000 to 15,000 fpm compared with 300 to 600 fpm. For this reason, the system of extraction at source has come to be known as the "low volume high velocity system."

The selection of suitable dust extraction hoses is very important, as these must be light, flexible, resilient and have a smooth bore which is resistant to the abrasion of small particles of metal and grinding wheel at high velocities.

For the lower extraction rates, PVC or neoprene hose of 7/16, 5/8, and 3/4 in. bore has been used. For higher extraction rates, wire reinforced rubber and canvas hoses have been found more suitable, though in all cases the bore must be free of corrugations and reinforcing wire must be embedded in the lining.

A minimum length needed to give the operator the freedom of movement he requires should be used. 10 ft is usually sufficient. If a greater length is needed, an extension of larger diameter should be attached, to keep the internal friction losses as low as possible.

For large installations the flexible hoses can be connected to rigid ducts which are increased in diameter as the volume of air to be extracted is increased. It has been found that standard steam piping using directional fittings gives good results.

Filters Are Part of System

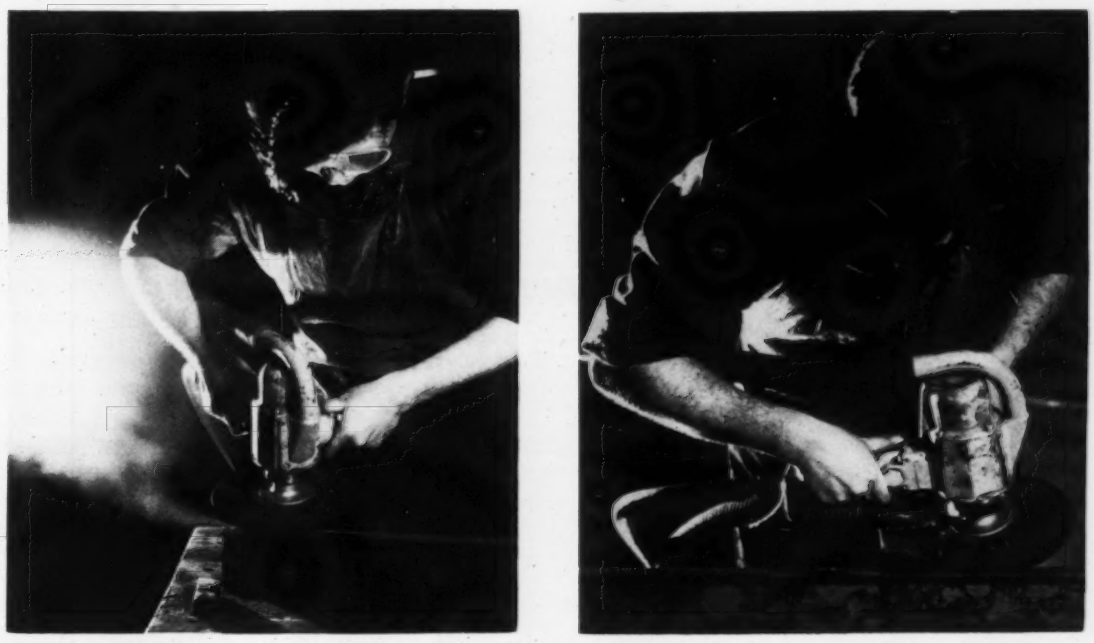
Filters used for the collection of dust can be of conventional design with high efficiency cyclone separators fitted to them to remove the bulk of the solid material from the air stream before it enters the filter itself. To insure proper operation, filters must be of adequate area to keep resistance and velocities low, and efficient enough to remove the size particles encountered.

Multi-stage centrifugal blowers of the type used for industrial cleaning systems have proved most satisfactory for this type system. It is important that the exhaust equipment is of sufficient capacity to extract the volume of air required, through the necessary duct length, while maintaining the correct operating suction.

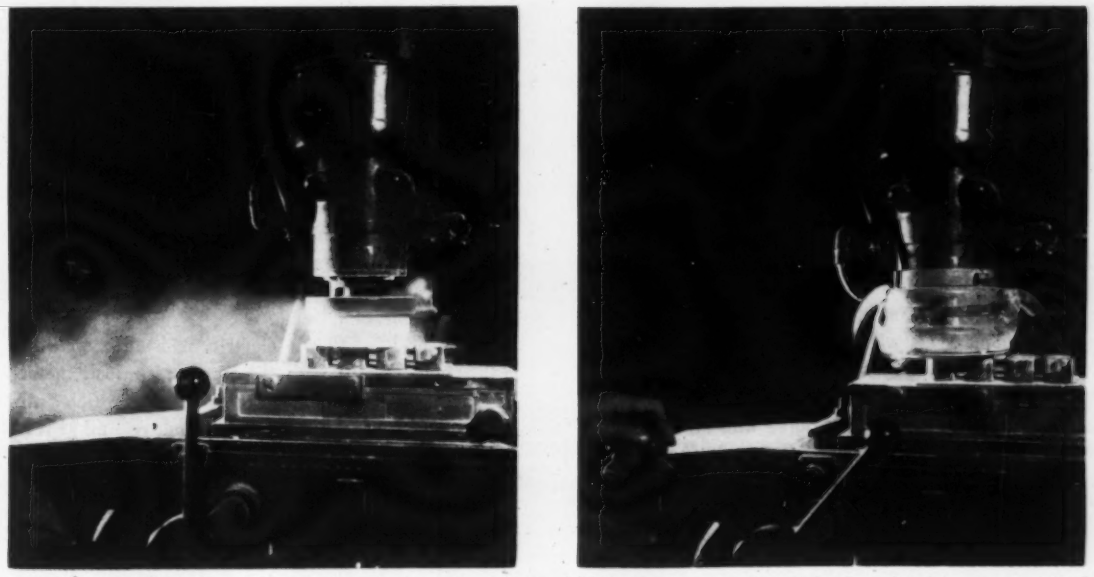
System Has Many Applications

While we have mentioned the early work accomplished in this field in connection with the foundry industry, and indeed the first applications were to tools in use in that industry, the system finds many applications in other processes where high speed cutters produce fine dusts of irritating or toxic nature. Plastic materials machining sometimes yields dusts which are highly poisonous, for instance. The system has been applied to carbon and cast iron machining, and for the recovery of valuable materials.

It has also been used, with considerable success, for the removal of metallic swarf from automatic machining operations which could not be carried out if the metal chips were allowed to accumulate. Again, this method has been used for removal of mer-



FLEXIBLE SANDER emits particle cloud of rail dust with extractor inoperative, almost no dust with removal system in operation



SYNTHETIC RESIN dust clouds from surface grinder at left. With extractor operating, right, harmful dusts are contained

cury fumes for the dry grinding of concrete, terrazzo and composition flooring polishing, and for pneumatic scaling hammers.

With the increase in the number and complexity of operations being carried out in modern industry and with the addition of many new materials, a dust extraction system which takes up so little space and which can remove the dust "at source" must find many applications. ∓

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[1]*Garrett Report* of the Joint Advisory Committee on Conditions in Iron Foundries. 1947. H.M. Stationery Office

[2]Lawrie, W. B., *A Rapid Method of Dust Estimation in Iron and Steel Foundries*, presented at Society of the Chemical Industry Conference on Dust in Industry, September, 1948.

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Will the American Piping Industry Prosper?

By EDWIN A. BUXTON

Mr. Buxton, now retired, was formerly manager of pipe sales for Bethlehem Steel Co., and was active in the steel and piping industry for many years. While this is a departure from the usual technical information published in HPAC, we feel his reflections on the past and present development of the field to which he has devoted so many years will be of interest to all engineers.

Mr. Buxton's sympathies on the question of rising competition from foreign producers will be readily apparent. While every engineer may not agree with his opinion on the extent of this situation and what to do about it, this is something about which we should all at least be informed. You will find Mr. Buxton's comments both sincere and thought-provoking.

IN THE EARLY DAYS of steel pipe (or better, tubular products) beginning over 100 years ago, improvements in that product were confined largely to improvements in welding techniques. The chemistry of producing welded steel pipe required a low carbon content, and of course the physical properties of the finished product were limited; and restrictions on end use were obvious.

Furnace weld, fusion weld, arc weld, butt weld, and lap weld methods were developed, and when seamless pipe made its appearance about 1927, it represented a significant contribution to a great variety of industries.

Seamless pipe, although more difficult to produce with uniform wall thickness, not only provided higher hydrostatic strength, but the process lent itself to a product with higher carbon content and consequently more advanced physical properties.

Various alloys came into being; each with great strength, heat resistance, or heavier wall capability, etc. All of which opened up not only new fields for pipe, but whole new industries.

In the middle 1930's electric resistance welding was developed, and with the many technical, metallurgical, and chemical improvements which are constantly being made, both seamless and ERW pipe have contributed materially to the rapid advance of American industry.

Mechanical tubing and pressure tubing are produced in alloy, carbon, and stainless varieties to make possible the many heating, piping, and air conditioning goods which now we can take for granted.

The Need for Pipe Is Constant

It is hard to imagine a product which does not, at one time or another, depend on steel for its being, even with today's many other available metals. Likewise pipe, somewhere or other, is involved in the production of almost every good or service. Pipe has in fact more than kept its place percentagewise in the family of steel products. For example, 45,850,-

825 tons of steel products were shipped in 1940, of which 3,920,200 tons were pipe. In 1950 shipments of steel products rose to 72,232,292 tons. Pipe accounted for 8,953,840 tons of that amount. Since 1950 pipe has consistently represented about 12 percent of all steel product shipments.

This is a story of hard work, continuous improvement, and the definite fact that it would have been virtually impossible to have made the progress we have without pipe.

The Future Should Be Big and Bright

Today we are in a period of great change and development, and from this period should develop a series of discoveries and improvements that will open a new and bright future for pipe of all kinds. In comparatively recent years great strides have been made toward the perfection of tubular products of all kinds — copper, aluminum, asbestos, plastics, and composites. This is good, since competition leads, or ought to lead, to greater things.

Improved metallurgy, chemistry, and operating practice should ultimately enable us to do away with slower, or less efficient methods of making and using tubular products. The pipe of the future may well be extremely light, of a variety of workable materials, and coated with plastics or other compounds which will serve specific and useful purposes.

The Question of Import Competition

It must be realized that the competition which will produce improvements in the piping industry in this country will be affected greatly by the importation of various tubular products made at labor rates much lower than ours. These products, while cheaper, are in most cases of good quality.

Bear in mind that, right or wrong, allocation of money for research or improvement is more readily available from management when profit is being made. Less profit is being made in the domestic steel pipe industry today because imports are lowering the domestic rate of production. The following Table will indicate the extent to which imported pipe is being absorbed in our industry.

Time period	Buttweld imports, tons	Percent of domestic standard buttweld shipments
1959 (12 mo.)	553,139	31.5
Jan., 1960	50,955	22.1
Feb., 1960	50,013	25.8
1960 (12 mo.)	480,091	30.5
Jan., 1961	28,867	29.9
Feb., 1961	39,310	41.4

Note that while the tonnage figures may vary, and even decrease, the important point is that the ratio trend of imports to domestic-produced goods is consistent to slightly increasing.

Can We Compete?

There are two operational questions which should be asked immediately:

1) Is it possible at all to produce pipe with domestic labor rates and compete with much lower foreign rates?

2) Can quality be improved enough to offset the lower foreign prices?

After this, there are several broader questions that all franchised citizens should contemplate:

1) To what extent should domestic markets be sacrificed to the necessity of maintaining foreign friends' production?

2) If taxes are not paid on domestic profits, where will government revenue come from?

3) Cannot an effort be made to limit importation to a point where American industry is moderately protected — in other words, what are the pros and cons of a quota system?

4) What will be the effects of the alternative that is being used more and more today — whereby American producers are forced to manufacture a product in other countries and then bring the product here?

The Answer: American Know-How

Every engineer knows that the quality received from a machine or a design will be in exact proportion to what was put into it. The industry, therefore, must "put in" cooperation, intelligent research, unselfish action, and exercise of the rights of citizenship.

It is clearly possible that by coordinating the values of steel and the corrosion values of plastics, aluminum, copper, and other materials, a combination of greater values in tubular products can be produced. This would be progress.

It is clearly possible that intelligent research can produce lighter wall pipe, still with ample strength, and this would be progress.

It is clearly possible that a combination of materials will allow advances in specific areas such as, say, threadless pipe, and again, this would be progress.

It is somewhat possible that if those concerned with the production, distribution, and use of pipe take pains to make themselves heard, some solution, such as a quota system, can be found to the problem of foreign competitive advantages.

Though we have limited this discussion mostly to the piping field, it will be realized that these same things apply in greater or less degree to other heating, piping, and air conditioning products as well. What is needed is joint effort toward solution. ≠

How to Construct High Altitude Psychrometric Charts

By ROGER W. HAINES
Bridgers & Paxton
Consulting Engineers, Inc.

Standard sea level psychrometric charts cannot be used directly in those areas of the country — notably the southwest — where urban elevations vary from 4000 to 8000 ft. Charts constructed to match particular elevations will be of material help in improving the accuracy of air conditioning design. Mr. Haines details the calculations and procedures necessary to the making of such charts.

THE INCREASE in population and construction in the southwestern States, especially at military bases and atomic research installations, has led to a great increase in air conditioning in this area.

Since large parts of New Mexico, Arizona, Utah, and Colorado lie at elevations of from 4000 to 8000 ft, the standard sea level psychrometric chart is not directly useable for installation designs in those areas. Therefore the development of high level psychrometric charts to the same scale and arrangement as the standard chart will aid in improving the accuracy of air conditioning design.

To do this, it is necessary to calculate new tables from the Goff & Gratch tables in the ASHRAE GUIDE[1] for 26, 25, and 23 in. Hg pressure, which values correspond to 3850, 4900, and 6900 ft above sea level, respectively. These altitudes cover the more important localities in New Mexico and Colorado.

Chart Construction

The calculation and construction of psychrometric charts is quite a tedious job, but the following explanation will serve those who wish to construct charts for other altitudes. The bases for all calculations are the tables by Goff and Gratch in the 1960 edition of the GUIDE, Chapter 3, Tables 2 and 3. These are, of course, for sea level.

Values for any given barometric pressure are calculated from the sea level tables as follows:

Humidity Ratio, W

The equation for humidity ratio is

$$W = 0.622P_e/(P - P_e)$$

[1]See References at end of article

TABLE 1 — THERMODYNAMIC PROPERTIES OF MOIST AIR at 25 in. Hg pressure (4900 ft elevation)

Dry bulb temperature, F t	Humidity ratio, $W_s \times 10^2$	Volume, cu ft per lb, dry air V_a	V_{as}	V_s	Enthalpy, Btu per lb, dry air H_a	H_{as}	H_s	Partial pressure water, in. Hg P_w
0	0.0936	13.83	0.021	13.85	0	0.992	0.992	0.0376
5	0.1217	14.00	0.027	14.03	1.201	1.291	2.492	0.0488
10	0.1569	14.16	0.036	14.20	2.402	1.670	4.072	0.0629
15	0.2012	14.31	0.046	14.36	3.603	2.145	5.748	0.0806
20	0.2562	14.46	0.060	14.52	4.804	2.740	7.540	0.1027
25	0.325	14.61	0.077	14.69	6.005	3.48	9.49	0.1303
30	0.411	14.76	0.098	14.86	7.21	4.41	11.62	0.1645
32	0.451	14.82	0.108	14.93	7.69	4.85	12.54	0.1804
35	0.510	14.91	0.122	15.03	8.41	5.49	13.90	0.2034
40	0.623	15.06	0.151	15.21	9.61	6.72	16.33	0.248
45	0.755	15.21	0.185	15.40	10.81	8.16	18.97	0.300
50	0.914	15.36	0.225	15.59	12.01	9.90	21.91	0.362
55	1.104	15.51	0.275	15.79	13.21	11.98	25.19	0.436
60	1.328	15.66	0.334	15.99	14.41	14.40	28.81	0.522
65	1.589	15.81	0.403	16.21	15.61	17.30	32.91	0.622
70	1.891	15.96	0.485	16.45	16.82	20.66	37.48	0.739
75	2.255	16.12	0.584	16.70	18.02	24.66	42.68	0.875
80	2.680	16.27	0.700	16.97	19.22	29.38	48.60	1.032
85	3.177	16.42	0.837	17.26	20.42	34.82	55.24	1.214
90	3.75	16.57	0.998	17.57	21.63	41.24	62.87	1.422
95	4.43	16.72	1.19	17.91	22.83	48.90	71.73	1.661
100	5.21	16.87	1.42	18.29	24.03	57.6	81.6	1.933
105	6.14	17.02	1.67	18.69	25.23	67.9	93.1	2.244
110	7.20	17.18	1.99	19.17	26.43	79.8	106.2	2.597
115	8.46	17.34	2.36	19.70	27.64	94.0	121.6	2.996
120	9.95	17.50	2.80	20.30	28.84	110.7	139.5	3.447

and the humidity ratio at saturation:

$$W_s = 0.622P_{ss}/(P - P_{ss})$$

where

P_w = partial pressure of water vapor in the air, water vapor mixture at given DB temperature
P = total barometric pressure of mixture
s = subscript to denote saturation

The partial pressure of the water vapor at saturation is a function of the dry bulb temperature only, and can be taken directly from the sea level tables. Then W and W_s can be readily calculated for any barometric pressure and vapor pressure.

Volume, V

The specific volume of dry air is calculated from sea level values by means of the perfect gas law. (Air behaves very nearly as a perfect gas in the pressure and temperature range with which we deal here.) The volume at any altitude, therefore, will be equal to the volume at sea level times the ratio of sea level pressure at altitude.

The percent increase in specific volume due to the water vapor which is in the air is, according to Goodman[2]

$$\text{Percent increase} = 100P_s/(P - P_s)$$

then

$$V_{as} = V_a(\text{Percent increase})$$

and

$$V_s = V_a + V_{as}$$

where

V_a = specific volume of dry air at given pressure and DB temperature
V_{as} = specific volume of water vapor
V_s = specific volume of the mixture

Enthalpy

Enthalpy of dry air, h_a, (Btu per lb of dry air) is a function of the DB temperature only (at ordinary temperatures and pressures) and is taken unchanged from the sea level tables. It should be noted that the zero enthalpy used by Goff and Gratch and also in these tables is an arbitrary value, not absolute. In solving air conditioning problems by means of these graphs and tables, only enthalpy *differences* may be used.

The enthalpy of the water vapor in the air is determined by

$$h_{as} = W_s h_g$$

where

h_g = enthalpy of saturated water vapor, determined from sea level steam tables

Also,

$$h_s = h_a + h_{as}$$

where

h_s = enthalpy of moist air at saturation, Btu per lb of dry air

To construct high altitude charts from tables calculated as above, certain additional data are needed.

Percent saturation, μ, is easily obtained since

$$\mu = W/W_s$$

Relative humidity, ϕ, is defined by the equation

$$\phi = P_v/P_{vs}$$

To express ϕ in terms of W, note that

$$P_v = WP/(0.622 + W)$$

and

$$P_{vs} = W_sP/(0.622 + W_s)$$

then

$$\phi = P_v/P_{vs} = [WP/(0.622 + W)]/[W_sP/(0.622 + W_s)]$$

From this we obtain

$$W = 0.622W_s\phi/(0.622 + W_s - \phi W_s)$$

Then W may be calculated for any stated value of ϕ, dry bulb temperature and barometric pressure. In constructing the charts, ϕ may be taken as 0.1, 0.2, etc., through 0.9 for every 5 F DB temperature above 40 F. Above 80 F, only those percentages which fall within the chart need be calculated.

Wet Bulb Lines

To determine the slope of the wet bulb lines, it is necessary to calculate the enthalpy for the WB temperature at zero relative humidity ($W = 0$). The value at saturation is, of course, the same as for DB temperatures, that is, h_s.

The enthalpy of the water in the air per lb of dry air at saturation is $h_v \times W_s$ (where h_v equals the enthalpy of water vapor, Btu per lb of dry air). Then the enthalpy of the dry air at the WB temperature is

$$h_a = h_s - (h_vW_s)$$

This value can also be obtained more rigorously from the adiabatic saturation equation

$$W_1 = [W^*_sh^*_{fgs} - 0.24(t_1 - t^*_s)]/[h_{g1} - h^*_{fs}]$$

where

W_1 = specific humidity at DB temperature t_1
h^*_{fgs} = enthalpy due to latent heat of vaporization of water vapor in the mixture
h^*_{fs} = enthalpy of liquid water
h_{g1} = enthalpy of saturated water vapor at temperature t_1
$*$ = denotation that properties are evaluated at thermodynamic WB temperature

and

W^*_s, h^*_{fgs}, h^*_{fs}, and t^*_s are evaluated at saturation for the thermodynamic WB temperature t^*_s

This equation is used to find WB slope values in the upper right hand portion of the chart, and also if W_1 equals zero, then the equation simplifies to

$$t_1 = t^*_s - (W^*_sh^*_{fgs}/0.24)$$

This gives the value of DB temperature t_1 at which the WB temperature line intersects the base line $W = 0$. It will be noted that the slope of the WB lines changes abruptly at 32 F because of enthalpy change due to freezing.

Dry Bulb Enthalpy

Since the chart in our example (Table 1, 4900 ft) is limited by values of $W = 0.026$, it is necessary to calculate enthalpies corresponding to DB temperature at $W = 0.026$. This is done by means of the following equations, using unsaturated values:

$$h_v = Wh_g$$

and

$$h_m = h_a + h_v$$

where

h_m = enthalpy of unsaturated moist air, Btu per lb of dry air

Specific volumes at the chart-limiting values of $W = 0.026$ and $t = 120$ F may be most easily obtained by noting that the percent increase in specific volume due to the water vapor in the air may be obtained for any value of relative humidity by substituting that value for 100 in the "percent increase" equation. Then total volume at that condition of t and ϕ may be easily obtained from the equations for the specific volume of the water vapor and specific volume of the mixture, noting that now we have an unsaturated condition.

Data Cover All Requirements

With these data, charts may be constructed to any scale, using the basic coordinates of enthalpy and specific humidity. As noted, these charts can be constructed to the same scale and to the same slope of enthalpy lines as are used on the ASHRAE sea level psychrometric chart. Certain comparisons can then be made:

1) Dry bulb temperature lines are unchanged with altitude.

2) The saturation curve and relative and percent humidity curves move to the left as altitude increases. That is, for a given dew point temperature, h_s is greater at higher altitudes.

3) As altitude increases, specific volume decreases and at a given temperature and relative humidity, specific humidity increases.

4) For given dry bulb and wet bulb temperatures, the relative humidity is nearly constant at any altitude. ∓

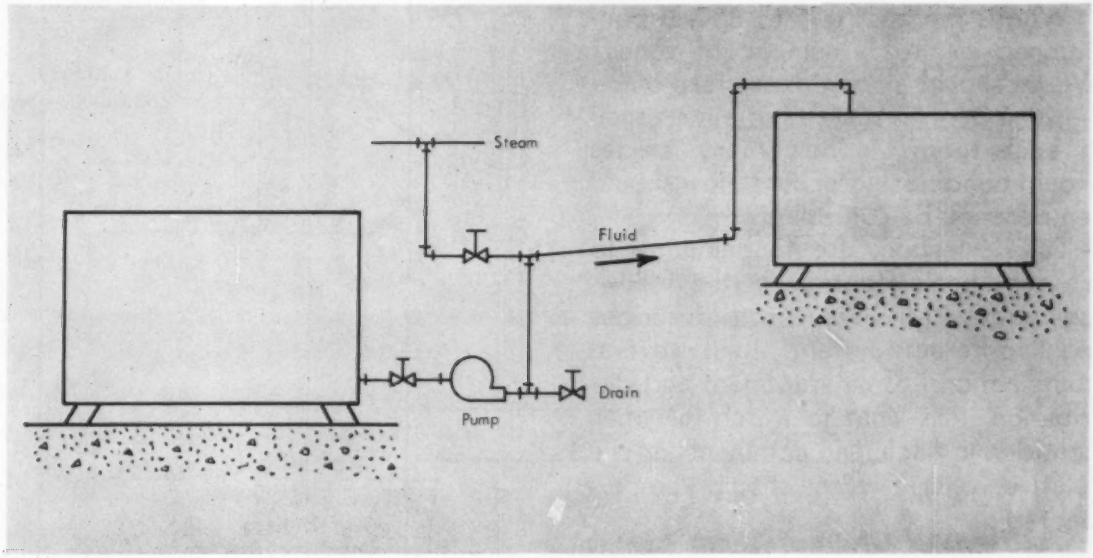
References

1) *Heating, Ventilating, Air Conditioning Guide*, ASHRAE, 38th Ed., 1960

2) Goodman, William, *Air Conditioning Analysis*, Macmillan Co., 1947

3) Sandfort, John, *Fundamentals of Psychrometrics*, Unpublished

Psychrometric charts have been constructed by the author for elevations of 3850, 4900, and 6900 ft above sea level. Reproductions of these are available at nominal cost to cover production expenses from the author at Bridgers & Paxton, Consulting Engineers, Inc., 213 Truman St., N.E., Albuquerque, New Mexico.



1 CONTINUOUS DRAINING proved to be solution to problem of how to quickly clear pipe of solidified material. As melted liquid drains away, steam is always in contact with solid matter

Piping tip —

A Better Way to "Unfreeze" Process Lines

By C. A. LEE
Mechanical Engineer
United States Steel Corp.

TWENTY-FIVE year's work in the chemical industry field affords an interesting and widespread experience in piping a variety of fluids, as well as with steam piping. As in other industries, most problems with chemical piping involve conventional techniques, but occasionally a more nearly unique project will present itself.

Many of the stocks or fluids that we piped solidified at temperatures below 100 F, so that once in a while a stock line would freeze up. We had hose connections throughout the plant, and could inject steam into water to get a hoseful of boiling water. We also had steam connections for blowing out the lines. The procedure was to put pressure on the line and play a hose along it until it blew clear. It might take an hour.

Tougher Problem

We had one high-melting material. That term is relative, since even this substance was quite fluid at 150 F. However, the melting temperature was high enough so that when this line froze we would take it down and melt out the sections. This was necessary (rather than blowing out the line in place) because the heat conductivity of the material was low and because there were no convection currents to help.

We found an "obvious" solution, but one which had not been in general use. All that was required was to bleed out the stock as fast as it melted, so that steam was always in contact with solidified stock.

Fig. 1 shows the system that was developed. The drain valve at the bottom of the vertical pipe section was opened when steam was applied at the top. As the stock melted, it drained to the outlet, allowing free steam access to the solid material. The success of this method was almost spectacular. ∓

What's the best way to deliver conditioned air to a number of zones? Where should air treatment take place — at a central source? in each zone? in each room? In how many stages should conditioning occur? How should temperature be controlled?

Such questions are fundamental to air conditioning design. In the following pages, Mr. Stevenson describes eight different systems (plus several combinations) of air treatment and distribution, tells what to watch for when considering each, and comments on the relative costs which should be expected[1].

By F. F. STEVENSON
Design Engineer

How to Select An Air Treatment-Distribution System

PROPER ZONING is a very important part of the air conditioning designer's work. While in most cases zoning is absolutely essential to adequate operation, it should always be remembered that more zones will mean greater expense, and it can be overdone.

The need for zoning arises out of variations in the cooling load in different parts of a building at the same time. The principal variation is usually due to a difference in sensible heat loads on various exposures. Large stores and similar structures are affected by differences in people load — an "interior" heat difference. Lighting and heat-emitting equipment also vary in different sections of a building.

How Need Develops

For a simple zoning problem, consider a "middle floor" of a building which has a large west exposure. The level above this floor is cooled, so that there is no heat gain from overhead. A series of rooms are located along the west wall, with another set of interior rooms paralleling these.

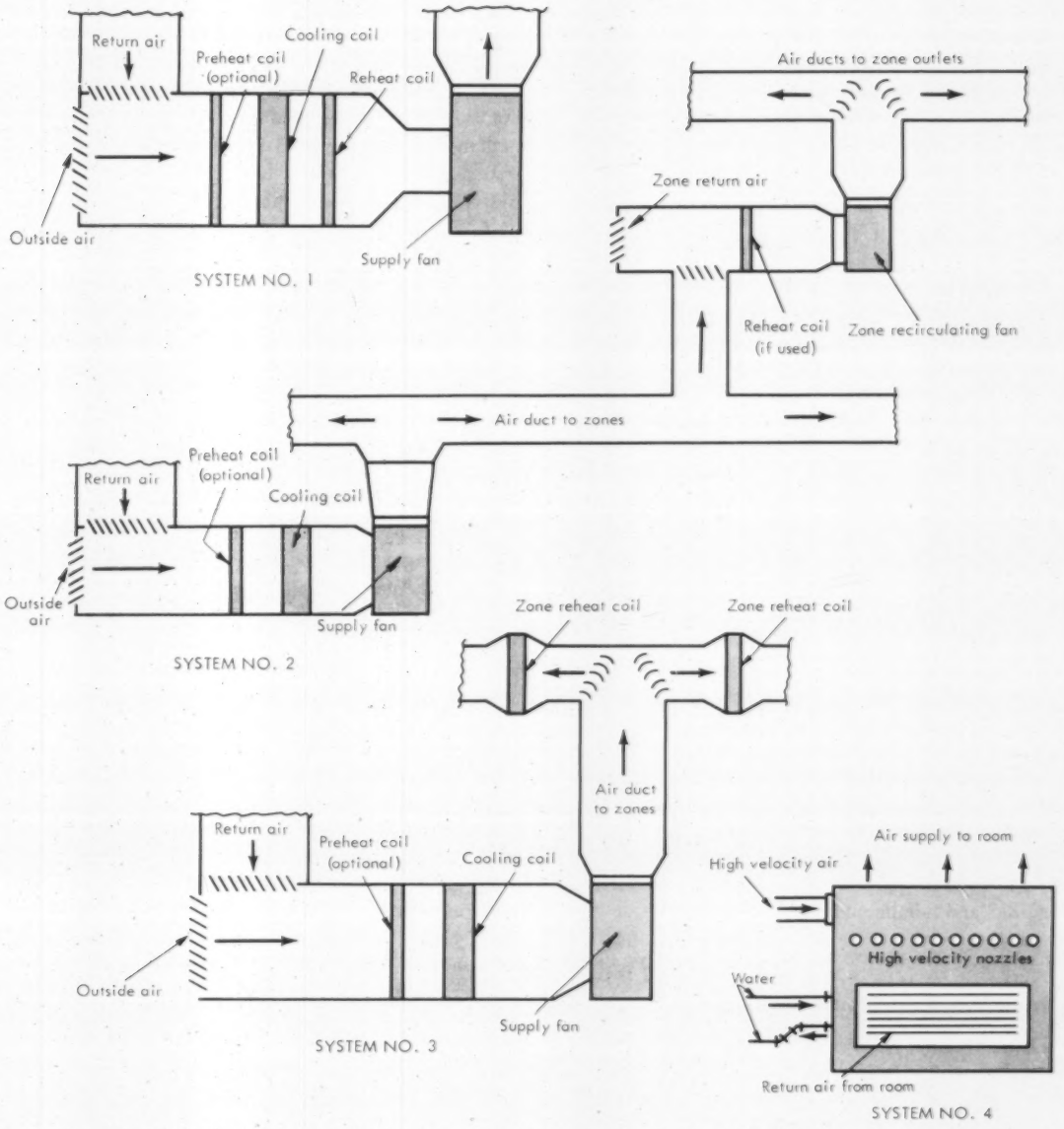
The design time of the load calculation is 4 PM. Without zoning, the control thermostat would normally be placed in one of the exposed areas, possibly the southwest corner room, which would have the maximum load at the design time.

Conditions would be satisfactory in the afternoon, with both interior and exterior rooms receiving the required amount of air at the right temperature.

During the morning hours however, lower outside temperatures and a lack of sun load on the west wall would produce a much lower than design load on the exterior rooms. Interior spaces, which would rarely have a load from outside, would experience about the same heat gain as they did in the afternoon.

The single thermostat in the exterior room would be satisfied with supply air at a much higher temperature than in the afternoon. This warmer air

[1]Last month Mr. Stevenson began this series of articles with a discussion of *The Essential Factors in Cooling Load Calculations*. A third article will discuss in detail ways to control central air conditioning plenums.



1 FIRST FOUR SYSTEMS described in text are illustrated above. First, (upper left) includes a central coil and fan station for each zone, with all necessary heating and cooling coils and provision for outside air intake; is most efficient, but costly. Second system (center) uses central conditioning station for many zones but individual air mixing station, with fan, for each; air temperature is controlled by outside/return air mixing, but all air must be cooled down to required dew point temperature for zone with greatest latent load. Third system (lower center) uses central fan and primary coils but individual zone reheat coils, is very flexible and provides both winter heating and humidification, but is susceptible to high operating costs since cooling must be done to point of greatest zone load. Fourth, induction system (lower right) is applicable primarily to commercial buildings with large outside exposures, provides individual room control through multitude of induction cabinets

will not handle the unchanging load in the interior spaces, where temperatures will rise to an unsatisfactory level.

Solution: Proper Zoning

This situation calls for zoning each of these areas separately, furnishing each with independent air supplies. There are of course many other reasons for zoning, some much more complicated than we have illustrated here.

For instance, many buildings will require simultaneous heating and cooling in different areas. In an average building, with exposure on two or more exterior walls, both heating and cooling will likely be needed when outdoor temperature is between 40

and 65 F. Some rooms will require morning heating, mid-day cooling, and heat again around 4 to 5 PM.

Some interior rooms with high people, lighting, or electric motor loads will require cooling year 'round, no matter what the outdoor temperature. This may not be easily supplied unless considerable quantities of outdoor air can be introduced into the system.

Provide for Enough Outside Air

If the supply air temperature split during the summer is, say, 20 F (80 F room air and 60 F supply air) then unless the load changes in winter the 20 F split will have to be maintained. But the design room temperature in winter will be 70 F (80 F being too warm) so that supply air must be at a temperature of 50 F.

If the system is designed to deliver air at 60 to 58 F, it may not be able to handle this winter load. To meet this situation, the system should be designed to handle considerable amounts of outside air, which at a lower temperature can be mixed with return air to give a mixture temperature suitable for winter cooling. This reduces the need for operating refrigeration equipment in winter.

An economizer type of central fan station should be used here. Such a station mixes outside and return air to hold a steady plenum temperature by means of modulating dampers and a control thermostat. Ideally, this system would be able to handle 100 percent outside air.

With 50 F air flowing in the ducts, care must be taken to insulate properly in order to avoid surface sweating and similar condensation trouble at the air outlets.

Zoning May Take Many Forms

There are many ways of zoning air distribution systems. Eight principal methods will be discussed here. These are:

1) Individual central fan and coil stations for each zone.

2) A central fan and coil station plus individual air mixing stations for each zone.

3) Individual zone reheat stations.

4) Individual room type air induction units — one or more per space.

5) Double central station and double duct systems.

6) Double central station system.

7) Combination central station systems.

8) Air modulation systems.

System No. 1

The first of these (Fig. 1) uses a fan and coil station for each zone of the building, thus giving all zones individual air treatment and control. A central refrigeration unit serves the entire complex.

Each fan station must be sized for its maximum load (regardless of at what time that load will occur) but the refrigeration unit may be sized for the simultaneous building load at design time. From the standpoint of efficiency, ease of control, and flexibility, this is the ideal arrangement.

Operation Will Be Highly Efficient

First cost will be high, but operating costs will be low because operating energy will vary closely with the load on each station.

Obviously, it may be difficult to find space for a number of large fan stations, and the cost of removing space from the rental areas should be taken into account.

This system provides individual zone cooling, dehumidifying, and reheating on the summer cycle, and heating and tempering, plus humidification, in winter. The fan stations may be of the economizer plenum type described earlier, and can be designed to use 100 percent outside air at certain periods. Most important, this arrangement allows simultaneous heating and cooling in different zones.

System No. 2

Individual air mixing stations for each zone (Fig. 1) will include a fan, plus an air mixing chamber with automatically controlled dampers.

A given air supply temperature in a particular zone is achieved by mixing return air with air supplied through a central fan and coil station serving all zones. A separate refrigeration unit may be used, or the cooling unit may be of a packaged variety. In either case, the coil in the central unit cools and dehumidifies the air for all zones during the summer, and heats and humidifies for all zones in winter. This central station can be of the economizer type.

Provides Good Summer Service

Such a system is used largely for summer comfort cooling applications, and for this purpose provides flexible and simple operation. In that case, though, system capabilities are limited because there are no individual zone heating facilities. Return air is used for zone reheat. With higher internal latent heat loads, this may not be too efficient.

All air must be cooled down in the central station unit to a dew point temperature low enough to meet the demand of the zone with the highest latent load. This may mean that air supplied to the zone mixing units is at such a low dry bulb temperature that an excessive amount of return air must be added to

bring the temperature up to a point suitable for some space requirements.

If the central station uses a mixture of return and outside air, such mixing may result in poor ventilation. Also, since the return air will have a higher moisture content than the air from the central station, the mixture supplied to the zone may be at too high a dew point to absorb the internal latent load.

This can be a vicious circle, with the central station supplying colder and colder air at the command of the humidistat and the zone mixing chamber providing more and more return air at the command of the thermostat.

When Reheat Is Used

Each zone mixing chamber is sized for its peak load regardless of time of day, and the central coil and refrigeration unit are sized for the simultaneous building load at design time. The cost of summer operation tends to be fairly high, since the central coil must cool all air in accordance with the demands of the zone having the greatest load. First cost is low, however, since each zone unit is comparatively inexpensive — and if there is no zone heating.

To make System No. 2 more adaptable in handling the latent loads, and to furnish zone heating or tempering in the winter, this system can be equipped with heating coils in each zone station. In this case, the central heating coil may be used for preheat, or be eliminated. Here we find summer reheat attained by a combination of air mixing and sensible reheat. Now, however, the system assumes the characteristics of the third method, and first cost increases greatly. Operating costs will do down, because the air mixing arrangement tends to reduce the time that unnecessary air cooling occurs. Also, with the reheat coils installed, the system will provide simultaneous heating and cooling. Zone winter humidification can also be provided with the reheat coils.

System No. 3

The next method is by means of an individual zone reheat system with a central fan and coil station serving all zones, but with simple coil reheat stations at each zone (Fig. 1).

The central station cools and dehumidifies all air and may be of the economizer type. The refrigeration unit can be separate.

Such an arrangement is simple, easy to install and control, and very flexible. It affords winter heating or tempering, and humidification, if desired. Each reheat coil is sized for its maximum load and the cooling coil and refrigeration unit for the sum of the zone peak loads, regardless of time.

The first cost of No. 3 is comparatively low, but the cost of operation very high. The cooling coil must be capable of cooling all the air down to the temperature required by the zone having the greatest load at any time of day; and to serve other zones with lesser loads, the air must be reheated.

This situation may require maximum refrigeration and reheat at the same time. Simultaneous heating and cooling is afforded, but at a price.

Despite its high operating costs, System No. 3 is a popular one with designers and owners, for the reasons given above — especially where steam and refrigeration condenser water costs are low. It is found in many industrial buildings.

System No. 4

System 4 (Fig. 1) is applicable primarily to office buildings, and similar structures with large outside exposures. This is essentially an individual room zoning means for both heating and cooling, using special air delivery cabinets which receive high velocity primary air from a central fan and coil station. Primary air is generally 100 percent outdoor supply, cooled to a low temperature in the summer. Volume is based on the heat transmission load of each room.

Primary air is so delivered through the cabinet as to induce a considerable flow of room air to mix with it. The relative volume of primary air is therefore quite low, and in many systems, no air is returned. This arrangement, together with the use of high velocity (small) supply ducts, makes for space saving and low installation costs. The former, of course, is of great importance in hotels and office buildings.

Room Cabinet Arrangement

A typical cabinet design might include a balancing damper through which primary air flows to enter the cabinet, after which it passes through a battery of high velocity discharge nozzles, creating an air induction effect which draws a fixed amount of room air into the cabinet, through a filter.

In the summer, this room mixture is sensibly cooled, but not dehumidified, by a chilled water coil. After cooling, the room air mixes with the cold primary air and is then discharged to the space. No fan is required in the cabinet itself.

Induction System Limitations

Air mixing with this system (No. 4) is similar to that which occurs with the No. 2 method. The same limitation — the inability to handle high internal latent heat loads — applies.

If the water supply to the cabinet coil is reduced in temperature so that the coil dehumidifies the return air, the condensate drip from the coil must be

disposed of by means of a drain pipe from the cabinet to a waste line. Such piping can add considerably to the cost of the system.

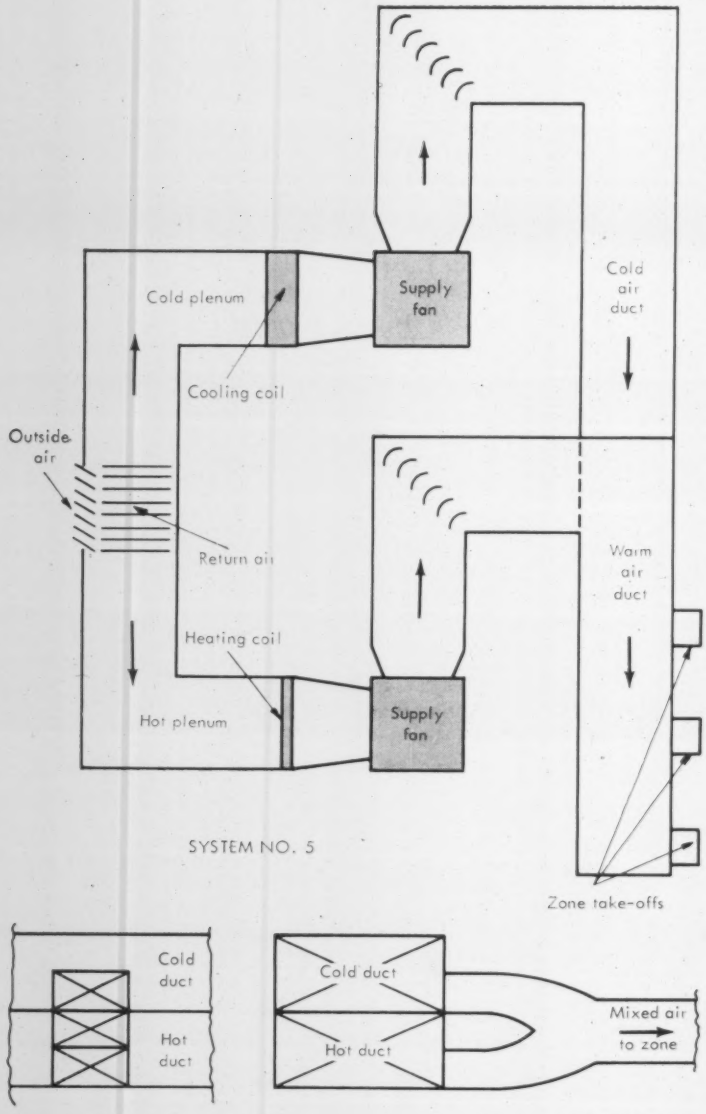
Temperature control will be by means of a water control valve, manual or automatic, which regulates the flow of chilled water to the coil. A central fan and coil station, handling all outside air, constitutes the source of primary air supply. A single refrigeration unit can be used to supply both the central (primary air) coil and the coils in the room cabinets during the warm months.

In winter, cold primary air is still supplied to the cabinets, but the individual coils receive hot water from a boiler or converter. The induction effect is such that the resulting air mixture temperature is warm enough to absorb the heating load. The same water control valve regulates flow to the coil.

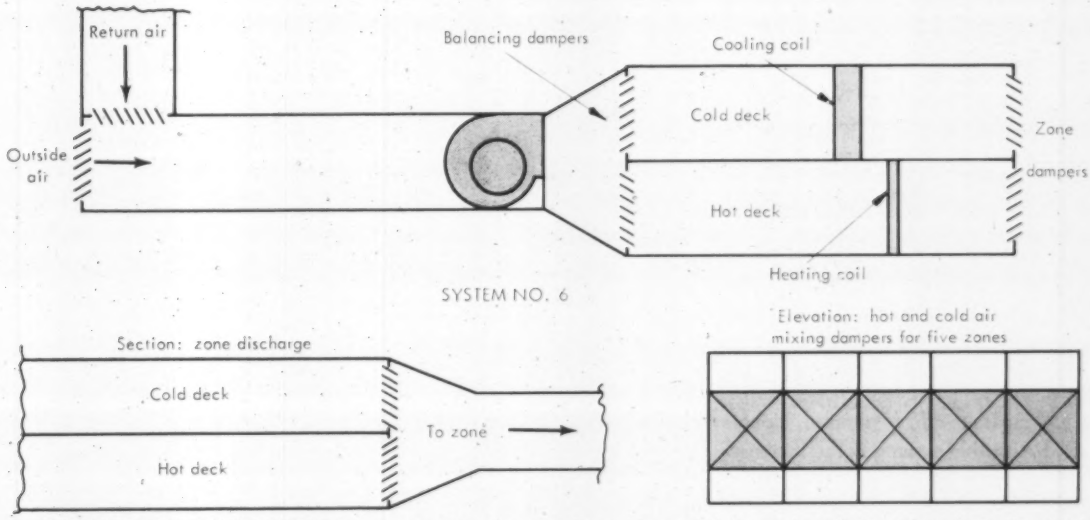
During the spring and fall, — "in between" temperature periods — several alternatives are available. Primary air may be heated, but hot water supply to the cabinet coils shut off. This arrangement will provide for necessary heat in the exterior spaces, but does not allow for interior cooling which may be required, unless chilled water is piped to the inside-room coils.

Ideally, a three-pipe arrangement can be used so that either hot or chilled water can be supplied to any one of the individual coils, with a common return. This affords maximum flexibility on a room basis. Something less than this, with hot or chilled water supplied on a zone basis, may be acceptable, however, and less expensive.

The chiller for this system is sized for the simultaneous building load at design time, because the flow



2 DOUBLE central station system with double (heating and cooling) ducts to the various zones requires considerable space, making first cost high. System is flexible, and should operate at low cost once proper balancing is effected. Air is mixed adjacent to each zone, with air flow controlled by zone thermostat



3 DOUBLE CENTRAL STATION system consists of two compartments or decks to furnish heating and cooling functions, respectively. Merged ducts are run to each zone; air flow, temperature are controlled by dampers on decks

of chilled water to the main cooling coil and to the cabinet coils is reduced in proportion to the decrease in load. Room units are sized for peak room load at any time, but will never impose the collective maximum possible load on either the refrigeration unit or the central station coil, for reasons described above.

The first cost of System No. 4 is moderately high, although its space saving potential may be an important factor in reducing overall building costs. Operating costs should be moderate.

System No. 5

This method consists of two central stations; one for cooling and the other for heating, with supply ducts from each station to the various zones. Hot and cold ducts are joined in the zone, and air is mixed in accordance with the demands of the zone thermostat. It will be obvious that this system (Fig. 2) cannot be installed where space is at a premium, because the two central stations and the two main ducts all have to be sized to handle the total load.

First cost is therefore quite high. The system is flexible, and should be easy to control once the central station modulating dampers are balanced. Static pressure regulators are sometimes provided to modulate air dampers, which in turn control the air flow into each station.

Operating costs should be low, with the load on the cooling coil and chiller being the simultaneous building load at design time. Zone ducts and mixing chambers are sized for peak load at any given time.

Winter humidification may be obtained at the heating central station or at the zone take-offs. Air flow from each zone duct (hot and cold) is controlled by a zone thermostat acting on synchronized dampers. Humidity in summer can be controlled by humidistats acting on the main cooling coil, or on a zone basis.

System No. 6

Here one central fan and coil station consisting of two compartments or decks is used. One deck furnishes the heating function; the other cooling and dehumidification. Zone air take-offs are located at each deck (Fig. 3) and the zone hot and cold take-offs joined immediately adjacent to the station. The merged ducts are then run to each zone.

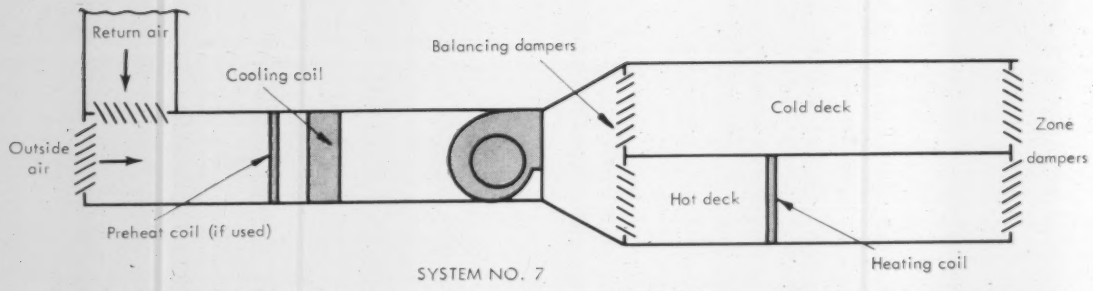
Static pressure regulators are sometimes used to help keep the flow of air balanced by modulating the air dampers at the entrance to each deck.

When more air is needed for heating in a particular zone, the zone thermostat acts to open the dampers of the zone outlets off the heating deck and throttles the dampers off the cold deck. This increases the resistance to the flow of air through the cold deck, and velocity pressure is changed to static pressure. The pressure regulator senses this effect and acts to throttle the cold deck entrance dampers, thus decreasing the in-flow of air.

System Accommodates One or Two Fans

A blow through type of fan arrangement is usually used with System No. 6, although a draw through flow of air may be obtained by using two fans, one at the outlet of each deck. The latter pattern may be easier to balance than the blow through arrangement, but of course the additional fan adds to costs.

First cost of this system with one fan is moderate, and operating costs relatively low. Once balanced, it is easy to control. A humidifier may be placed in the



4 COMBINATION CENTRAL STATION system has central unit divided in two, with fan installed between, making first (cooling) section draw through and second (heating) blow through. First section handles all air, second is divided into hot and cold decks

zone air take-off. If desired, double ducts may be used with this system, if the increased cost and space requirement can be absorbed. Load characteristics with System No. 6 are the same as described for No. 5.

System No. 7

The next arrangement (Fig. 4) utilizes a single fan and coil station divided into two sections, with the fan installed between the two. This makes the first section a draw through and the second a blow through device.

The first section handles all the air, but the second is divided into hot and cold decks, each sized for the total quantity of air. On the draw through side, a dehumidifying coil is installed, with an optional preheat coil. The hot deck (blow through) is equipped with a reheat coil.

Note that all air is dehumidified as it passes through the first section, as opposed to Systems Nos. 5 and 6 which supply untreated air for summer reheat purposes. The arrangement of No. 7 affords the advantage of being able to handle high latent loads. Zone take-offs are arranged in a manner similar to that of System 6. Control should be easy and positive once the system is balanced, and first cost is moderate. Operating costs are relatively high, however, since all air is cooled, after which much of it must be reheated.

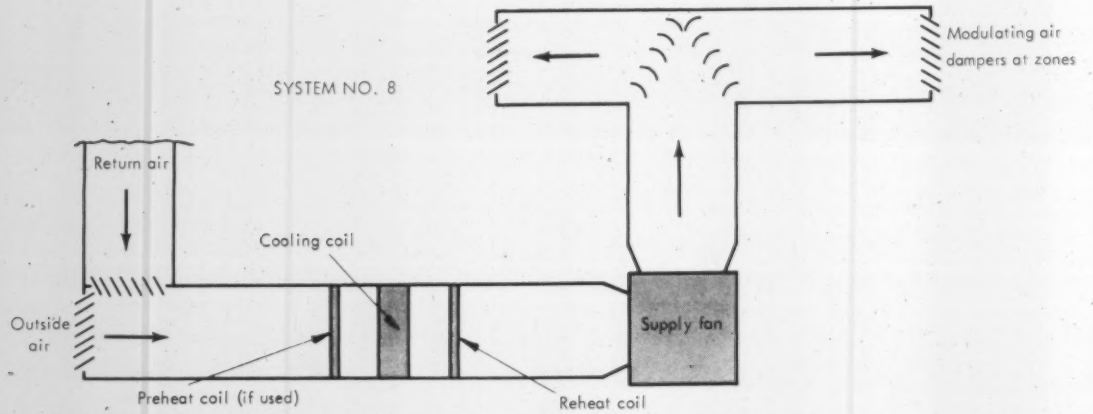
The cooling coil and refrigeration unit must be sized for the sum of the maximum loads from all zones. Finally, the draw through section of this system may be of the economizer type to help control operating costs.

System No. 8

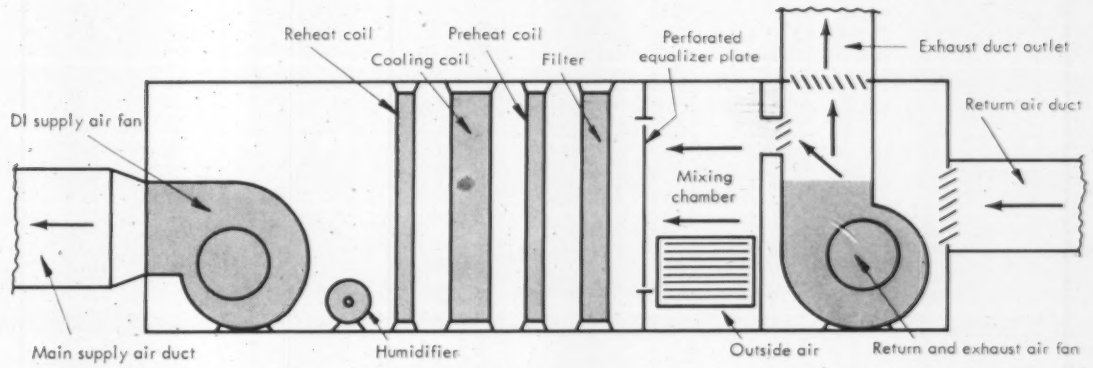
An entirely different concept of zone control is the principal feature of the No. 8 arrangement. Here, the air volume is changed to meet varying load conditions in each zone. Such a system is relatively simple and easy to install and also easy to control. As shown in Fig. 5, a single central station with preheat, cooling, and reheat coils is employed. Air flow to the various zones is controlled by means of modulating dampers. This results in generally low operating costs. However, such an arrangement is not a particularly efficient method of zoning. Air flow to the zones cannot be varied materially without upsetting the balance of the system as a whole.

The effects of changing the air flow include:

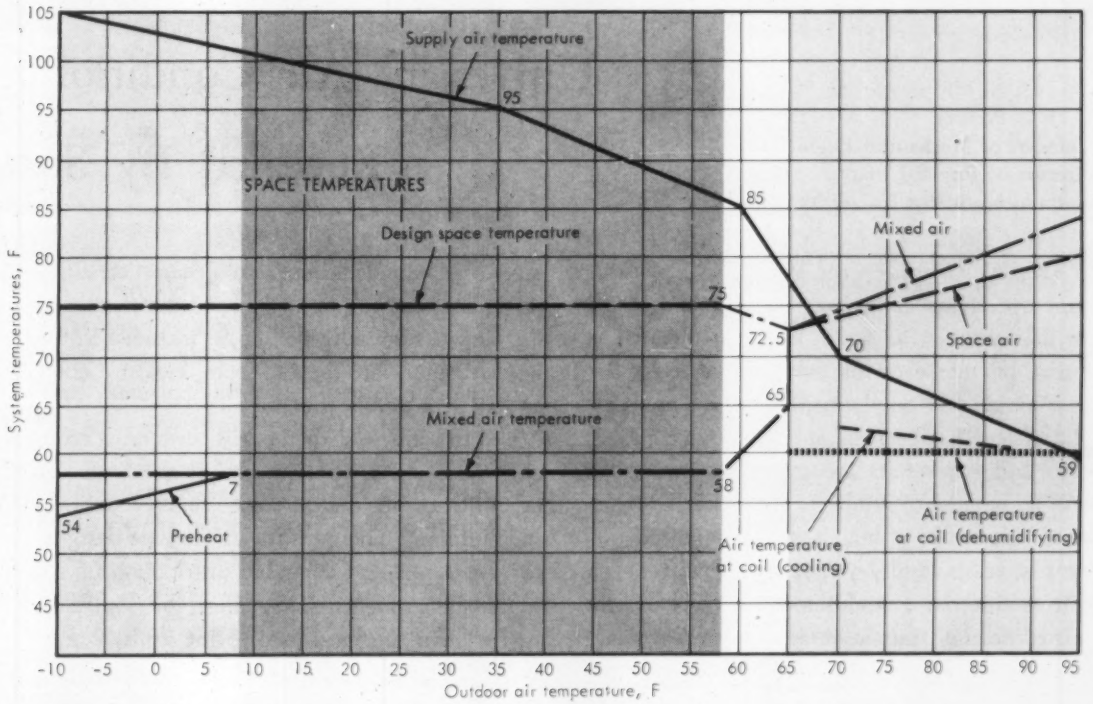
1) A colder than design supply air temperature when air flow to several zones is throttled at once.



5 AIR MODULATION DESIGN is principal feature of System No. 8, above. One central station treats all air. Modulating dampers control air flow to each zone and therefore zone temperatures. Text tells reasons why this is inefficient method



6-7 ECONOMIZER PLENUM, above, for central station requires two fans but allows variable outside/return air mixing to maintain constant plenum temperature. This is ideal arrangement to handle "in between" temperature periods, since 100 percent outside air can be used at times. Chart below shows operation of typical economizer plenum for design space temperature of 75 F in winter, 72.5 F in spring and fall, and variable from 72.5 to 80 F in summer. Mixture temperature (before coils) is kept at 58 F in winter. Minimum outdoor air (light gray areas) is admitted when temperatures are extreme, equals 25 percent. Dark gray indicates variable air mixing, white, 100 percent outside air. Details of plenum operation will be explained fully in next article of this series



2) An increase in air flow in some parts of the system when air to one or a few zones is throttled. A static pressure regulator can be used on the fan to control air volume when this happens, but with a number of zones, such control can be complicated.

3) Air volume control may not be satisfactory with high internal latent loads.

4) Simultaneous heating and cooling is not available. Supply air temperature for all zones is the same.

5) If the air is throttled severely to meet reduced cooling loads, the amount of outside air admitted to the system may be less than required.

6) Controls must be reversed for summer-winter operation. For instance, when space temperatures rise during warmer weather, the thermostat will call for more air; in winter, a temperature rise should produce the effect of reducing the air volume.

Sometimes No. 8 is used in conjunction with an arrangement similar to that of No. 2, where reheat coils are installed in the ducts for each zone. This eliminates the need for drastic changes in air supply, and also allows for simultaneous heating and cooling, but obviously will increase first cost.

In any case, this kind of a system should not be designed to allow an air volume variation of more than about 40 percent. ≠

University Air Conditioning Revealed By SMU

By D. C. Pfeiffer
Professor of Mechanical Engineering
Director of Physical Plant
Southern Methodist University

IN AN EFFORT to keep the efficiency of physical plant operations as high as possible and to get the maximum value from utilities purchased, a system of measurement and cost analysis has been initiated at Southern Methodist University. The system has been in operation since July 1, 1960 and the results are given herein for the first 12 months of study. It is proposed to continue this work, although it is recognized that the first year's results will be representative.

It is interesting and important to know the cost of heating and air conditioning for the various departments of a university. The method outlined here should prove helpful to others with similar responsibilities and the results of the study will be of interest to consulting engineers called upon to design central air conditioning systems for other universities.

The SMU Physical Plant

SMU has 35 permanent buildings on its campus of approximately 150 acres. The total floor area of all buildings is approximately 1,534,000 sq ft. For purposes of this analysis, the buildings served are divided into two general classifications; the teaching buildings and the non-teaching or self-sustaining buildings. Included in this latter category are the Coliseum, Health Center, and student dormitories.

Utilities are sold to the self-sustaining group and the revenue applied against the total cost of utilities, with the difference charged to teaching buildings. The rates for utilities are designed to give a fair and equitable distribution of cost to all departments. They must, of course, be higher than the rates paid to the utility companies to take care of unavoidable losses in transmission, distribution, etc. They should be lower than the rate charged by a utility.

The Central Boiler Plant

The boiler plant is comprised of three natural gas-fired boilers with rated outputs of 25,000, 30,000, and 64,000 lb of steam per hr, respectively. The two smaller units are operated only during the heating season. The maximum heating load during the period of study (1960-61) was 65,000 lb of steam per hr. Because of the

How much does it cost to air condition university teaching buildings? The answer to this question is important in an age when every effort must be made to increase utilization of limited teaching space. This analysis of SMU's utility costs including the cost of operating a 3,350 ton cooling system provides information which can be applied with proper corrections to other areas.

Costs

Utility Analysis

construction of two new buildings, a maximum load of 80,000 lb per hr is anticipated during the coming winter. A fourth boiler rated at 60,000 lb per hr is being installed to meet new system demands and anticipated expansion.

Boiler feedwater is treated in a zeolite softener, heated in a deaerating heater and supplied to the boilers at an average temperature of 200 F. One feed pump is driven by a steam turbine, two others have electric drives.

Steam is generated at 200 psig. Calorimeter measurements indicate approximately 2 percent moisture. Automatic combustion control maintains flue gas CO_2 at approximately 9 to 10 percent. At full load, the normal stack temperature is 450 F.

Assuming 2 percent moisture in the steam, the net heat added in the boiler is about 1016 Btu per lb of steam generated. Since the heating value of the natural gas is 1060 Btu per cu ft, boiler efficiency can be obtained by multiplying item A-2 in Table 3 by 1016/1060 or 0.96. Thus, seasonal boiler efficiency during the study was 0.96 x 0.742 x 100 or 71.2 percent.

TABLE 1 — AIR CONDITIONED building loads, chilled water flow rates, and floor areas are listed here

Building	Floor area, sq ft	Air conditioning load, tons	Chilled water flow at 2 GPM per ton
South chilled water circuit			
Caruth Hall	36,000	115	230
Letterman's Dorm	15,600	40	80
Coliseum	125,728		
Offices		80	160
Auditorium		1,200	2,400
McElvaney	75,601	229	458
	250,929	1,664	3,328
North chilled water circuit			
Fondren Library	72,000	110	220
Fondren Science	111,000	427	854
Perkins Adm. Bldg.	29,000	111	222
Lawyer's Inn	29,700	36	72
Storey Hall	50,688	279	558
Florence Hall	19,700	57	114
	312,088	1,020	2,040
West chilled water circuit			
Fincher Building	65,676	233	466
Bridwell Library	25,950	75	150
Kirby Hall	21,000	83	166
Perkins Chapel	9,000	32	64
Selecman Hall	25,700	113	226
Atkins Hall[1]	18,000	45	90
Patterson Hall[1]	25,100	10	20
Student Center	81,312	500	1,000
Boaz Hall	57,031	140	280
Shuttles Hall	41,048	90	180
Mary Hay Hall	35,480	75	150
Health Center	81,312	97	194
	515,009	1,493[2]	2,986

[1]*Not all air conditioned*
[2]*Not including Highland Park Church*

The Central Cooling Plant

SMU has one of the largest air conditioning systems of any college or university in the country. The plant, which has a nominal capacity of 3,350 tons, is comprised of two steam turbine driven centrifugal compressor units, each having a capacity of approximately 1,000 tons, and three 500 hp electric motor driven centrifugal compressor units, each having a rated capacity of about 450 tons.

The connected University load based upon design conditions is 4,167 tons. This includes 1200 tons for the Coliseum which can be served only after 6:00 pm Monday through Friday and on weekends. Due to the diversity between dormitories and class rooms, etc., the actual load on the system at design conditions is approximately 2,000 tons.

The total connected load on the refrigerating plant is 4,443 tons. This includes 276 tons for the Highland Park Methodist Church during the week. The total church load is approximately 600 tons on Sundays, but as no teaching buildings are in operation, this is not a factor in the capacity of the system. The church is installing a refrigeration plant to serve its air conditioning which will reduce SMU's maximum load to 4167 tons beginning in 1962. However, three buildings are under construction which will add 550 tons to the total university load.

Normal operating procedure is to run the steam turbine units during the daytime and the electric units at night, and on weekends and holidays. With this type of operation, an extremely high load factor on the electric service is obtained, resulting in a very low unit cost of electricity. The 12 month average unit cost for the period of study was 0.885 cents per kwh.

TABLE 2 — ALL SMU buildings are listed here by function with floor area and air conditioning load given

	Floor area, Sq Ft	Air conditioning load, tons
Teaching buildings (air conditioned)		
Caruth Hall	36,000	115
Fondren Library	72,000	110
Fondren Science	111,000	427
Perkins Administration	29,000	111
Storey Hall	50,688	279
Florence Hall	19,700	57
Fincher Building	65,676	233
Bridwell Library	23,950	75
Kirby Hall	21,000	83
Perkins Chapel	9,000	32
Selecman Hall	25,700	113
Atkins Hall[1]	48,000	45
	511,714	1,680
Dormitories (air conditioned)		
Letterman's Dormitory	15,600	40
Lawyer's Inn	29,700	36
Boaz Hall	57,031	140
Shuttles Hall	41,048	90
Mary Hay Hall	35,480	75
McElvaney Hall	75,601	229
	254,460	610
Coliseum	123,728	
Offices		80
Auditorium		1,200
		1,280
Student center (air conditioned)	81,312	500
Health center (air conditioned)	27,281	97
Teaching buildings (non-air conditioned)		
McFarlin Auditorium	50,000	
Dallas Hall	50,000	
Hyer Hall	30,000	
Atkins Hall	48,500	
Engineering Labs. (I, II, III.)	78,280	
Women's Gym	14,191	
Perkins Natatorium	23,000	
Steam Plant (Patterson Hall)	25,100	
	318,971	
Dormitories (non-air conditioned)		
Virginia Hall	32,700	
Snider Hall	30,600	
Peyton Hall	38,600	
Smith Hall	22,350	
Perkins Hall	22,350	
Martin Hall	17,000	
Hawk Hall	19,200	
Moore Hall	34,200	
	216,900	
TOTAL	1,534,366	4,167
Total (less ½ of coliseum)	1,477,366	

[1]*Not all air conditioned*

What Space is Air Conditioned?

The load served by the central refrigerating plant can be divided into three general classes:

1) The normal load of the dormitories and the Student Union Building, which is metered and sold by the Physical Plant Department.

2) The load of the teaching buildings and administration offices, which is not metered, but furnished by the Physical Plant Department.

3) The two special services; one for the Highland Park Church, which is metered, and the other, the Coliseum, which while metered can only be served at such times as the normal load is not in operation.

The University's air conditioned space consists of the following:

1) Twelve teaching buildings having a total floor area of 511,714 sq ft and a connected load of 1,680 tons.

2) Six dormitories, totalling 254,460 sq ft

of floor area with a connected load of 610 tons.

3) The Coliseum with 123,728 sq ft of floor area, including offices, and a connected load of 80 tons for the offices and 1200 tons for the auditorium.

4) The Student Center having 81,312 sq ft of floor area and a connected load of 500 tons.

5) The Health Center with 27,281 sq ft of floor area and a connected load of 97 tons.

The various buildings included in each of the above groups are listed in Table 1, which is arranged according to the primary chilled water circuit supplying the buildings.

Four teaching buildings, three engineering labs, the women's gym, a swimming pool, and the steam plant are not air conditioned. These contain a floor area of 318,971 sq ft. There are also eight dormitories, which are not air conditioned from the central system, having a total floor area of 216,900 sq ft. A few window air conditioners are installed in these dormitories. All buildings are listed in Table 2, which is arranged according to building function and whether air conditioned or non-air conditioned. Floor areas and air conditioning loads where applicable are given in Table 2.

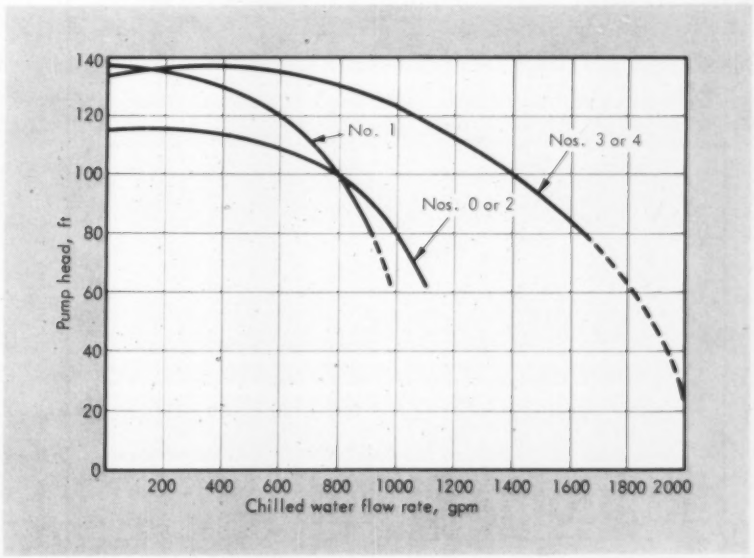
Results of 12 Month Study

All pertinent data for obtaining a complete cost analysis of the utilities operation at SMU is given in Table 3. The data are for the fiscal year ending June 30, 1961. The table gives a complete analysis of the cost of gas, steam, and air conditioning, both by steam and electricity.

In Table 3, the total refrigeration effect sold is listed. This was obtained from meter readings. With Btu meters measuring the total ton hours produced by the refrigerating system, and Btu meters in the buildings where refrigeration is sold, it is possible to determine the approximate cost of air conditioning for teaching and the exact cost of air conditioning sold to the self-sustaining buildings.

In order to facilitate understanding how each item was determined, an explanation of each entry in Table 3 is given on the page facing the table. The method used for obtaining the cost of utilities for the teaching buildings was to determine the total cost to the University for utilities, then the revenue obtained from the metered services to the dormitories and other self-sustaining departments was subtracted from this with the difference representing the cost for utility services to the teaching buildings.

A summary of the entire study is given in Table 4. Included therein are unit costs for cooling the teaching buildings, cooling of all air conditioned buildings, heating of teaching buildings, heating of all buildings, and the cost of electrical services for lights, and miscellaneous power other than that required for air conditioning refrigeration. The value of having these unit costs is considerable, as it permits a more accurate de-



1 CHILLED WATER PUMP characteristics for five district pumps are given here. Pumps 0, 1, and 2 serve the electric motor driven chillers, pumps 3 and 4 serve the steam turbine driven chillers

TABLE 3 — MONTHLY SUMMARY of utility costs at Southern Methodist University for 12 months ending June 30, 1961 is given here

	July	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Dec.*	*Jan.*	*Feb.*	*March*	*April*	*May*	*June*	*Total*
A. Gas and Steam													
1) Total gas used, M cu ft	20,863	21,352	18,640	18,273	17,433	25,985	27,974	19,945	14,832	14,065	17,161	17,288	233,811
2) Total steam generated, M lb	16,730	17,700	15,650	14,170	12,783	18,829	19,110	13,411	10,480	10,125	11,758	12,810	173,556
3) Lb steam gen./cu ft of gas	0.80	0.81	0.839	0.775	0.733	0.724	0.683	0.67	0.706	0.719	0.72	0.741	0.742
4) Total cost of gas, $	3,924	4,027	3,580	3,619	3,974	6,050	6,521	4,734	3,560	3,350	3,518	3,430	50,287
5) Unit cost of gas, ¢/M cu ft	18.8	18.86	19.2	19.8	22.85	23.28	23.3	23.73	20.0	23.8	20.4	10.84	21.37
6) Unit cost steam (gas) ¢/M lb	23.5	22.75	22.87	25.5	31.08	32.13	34.1	35.2	33.9	33.0	30.0	26.77	28.97
7) Total steam for a/c, M lb	10,260	11,055	9,205	5,800	—0—	—0—	—0—	—0—	—0—	—0—	1,660	6,765	8,935	53,680
8) Cost of steam for a/c, $	2,411	2,515	2,105	1,479	—0—	—0—	—0—	—0—	—0—	—0—	546	2,029	2,392	13,477
9) Total steam sold, M lb	2,466	3,108	2,680	3,100	5,150	6,930	8,610	8,440	5,930	5,520	3,500	2,425	57,859
10) Money received for steam sold	1,110	1,399	1,206	1,395	2,319	3,469	4,736	4,645	3,264	3,038	1,927	1,334	29,840
11) Steam for teach. bldg., M lb	4,004	3,537	3,765	5,270	7,633	11,899	10,500	4,971	4,550	2,945	1,473	1,450	61,997
12) Operating labor — heating	—0—	—0—	—0—	658	1,316	2,632	2,632	2,632	1,974	1,316	658	658	14,476
13) Estimated cost of oil	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—	—0—
14) Net cost steam teach. bldg. (gas), $	403	113	269	745	1,655	2,581	1,785	91	296	—234	—438	—296	6,970
15) Total cost heating-teach. bldg., $	403	113	269	1,403	2,971	5,213	4,417	2,725	2,270	1,082	220	362	21,446
B. Electricity													
1) Total KWH purchased (thousands)	1,177.2	1,238	1,290	1,233.6	1,126	990	837.6	901.2	1,056	874.8	1,146	1,214.4	13,084
2) Total cost of KWH purchased, $	9,812	10,533	10,814	10,666	10,193	9,313	8,295	8,376	9,366	8,465	9,813	10,154	115,800
3) Unit cost of KWH, ¢/KWH	0.83	0.85	0.84	0.86	0.905	0.94	0.99	0.929	0.887	0.967	0.856	0.836	0.885
4) Total KWH sold	346,450	473,870	451,400	455,400	465,200	446,200	415,300	429,400	414,000	403,300	464,000	463,800	5,228,320
5) Money received for KWH sold, $	5,370	7,345	6,997	7,059	7,212	6,917	6,230	6,441	6,211	6,252	7,193	7,190	80,417
6) KWH used for a/c	167,800	212,400	147,000	97,800	66,000	7,800	15,600	32,400	60,000	60,600	117,000	103,800	1,088,200
7) Cost of KWH used for a/c, $	1,392	1,805	1,254	841	597	73	184	360	638	797	1,001	867	9,789
8) KWH used for teach. bldg.	662,950	551,730	430,600	680,400	594,800	536,000	406,700	439,400	582,000	410,900	565,000	646,800	6,507,280
9) Net cost of KWH teach. bldg., $	3,050	1,383	2,583	2,766	2,584	2,323	1,881	1,575	2,517	1,416	1,619	2,097	25,594
C. Water													
1) Total gallons used, M gal	7,260	9,240.2	12,974	15,010	6,140	7,880	4,911.4	4,340	4,956	5,039	6,824	7,824	92,398.6
2) Total cost (including sewer), $	2,228	2,732	3,330	3,753	1,535	1,972	1,314	1096	1,661	1,515	2,602	2,267	26,505
3) Total gallons sold, M gal.	5,353	5,836	7,280	7,980	6,000	3,920	3,760	4,570	4,860	4,950	5,400	3,908	63,817
4) Money received (incl. sewer), $	1,606	1,751	2,186	2,396	1,860	1,178	1,130	1,373	1,460	1,636	1,891	1,368	19,835
5) Net cost of water for teaching, $	622	981	1,144	1,354	—325	794	184	223	201	—121	711	899	6,667
D. Air Conditioning													
a. Electricity													
1) Total ton hr produced	760,101	909,514	664,112	452,195	79,977	10,235	17,357	33,970	65,664	138,309	577,987	611,045	4,320,356
2) Ton hr by electricity	209,864	253,233	190,044	148,608	79,977	10,235	17,357	33,970	65,664	70,699	129,850	113,764	1,323,265
3) KWH/ton hr (elec.)	0.799	0.838	0.773	0.658	0.825	0.762	0.898	0.953	0.913	0.857	0.901	0.912	0.762
4) Unit cost, ¢/KWH	0.83	0.85	0.84	0.86	0.905	0.94	0.99	0.929	0.887	0.967	0.856	0.836	0.885
5) Unit cost, ¢/ton hr (elec.)	0.663	0.712	0.649	0.566	0.746	0.716	0.889	0.885	0.81	0.828	0.771	0.762	0.674
b. Steam													
1) Ton hr by steam	550,327	656,281	474,068	303,587	—0—	—0—	—0—	—0—	—0—	67,610	448,137	497,281	2,997,291
2) Lb steam used for a/c, M lb	10,260	11,055	9,205	5,800	—0—	—0—	—0—	—0—	—0—	1,660	6,765	8,935	53,680
3) Lb steam/ton hr	18.6	16.8	19.4	19.1	—0—	—0—	—0—	—0—	—0—	24.5	15.1	17.96	17.9
4) Unit cost of steam, ¢/M lb	23.5	22.75	22.87	25.5	31.08	32.13	—0—	—0—	—0—	33	30	26.77	28.98
5) Unit cost, ¢/ton hr (steam)	0.437	0.382	0.443	0.487	—0—	—0—	—0—	—0—	—0—	0.808	0.453	0.481	0.518
E. Production Cost — A.C.													
1) Electric refrigeration, $	1,391	1,795	1,233	841	596	73	154	300	532	586	1,015	868	9,384
2) Electric auxiliaries, $	280	360	246	170	120	15	30	60	106	83	135	175	1,780
3) Steam refrigeration, $	2,411	2,515	2,105	1,479	—0—	—0—	—0—	—0—	—0—	546	2,029	2,392	13,477
4) Electric aux. for steam units, $	560	720	492	340	—0—	—0—	—0—	—0—	—0—	129	751	818	3,810
5) Operating labor chargeable a/c, $	2,632	2,632	2,632	1,974	1,316	—0—	—0—	—0—	658	1,316	1,974	1,974	17,108
6) Misc. services & supplies, $	300	300	300	300	300	300	300	300	300	300	300	300	3,600
7) Total cost of a/c, $	7,034	8,322	7,008	5,104	2,332	388	484	660	1,596	2,960	6,204	6,527	48,619
8) Unit cost of a/c, ¢/ton hr.	0.925	0.914	1.05	0.929	2.91	3.79	2.74	1.94	1.43	2.13	1.38	1.068	1.08
9) Income from dormitories, etc., $	4,260	4,455	4,026	4,048	1,843	260	184	341	865	822	1,070	3,345	26,419
10) Net cost of a/c teaching, $	2,774	3,867	2,982	1,056	489	128	300	319	731	2,158	4,234	3,182	22,200
F. Summary													
1) Heating and hot water, $	403	113	269	1,403	2,971	5,213	4,417	2,725	2,270	1,082	220	362	21,446
2) Electricity, $	3,050	1,383	2,583	2,766	2,384	2,323	1,881	1,575	2,517	1,416	1,619	2,097	25,594
3) Water, $	622	981	1,144	1,354	—325	794	184	223	201	—121	711	899	6,667
4) Air conditioning,$	2,774	3,867	2,982	1,056	489	128	300	319	731	2,138	4,234	3,182	22,200
5) Total, $	6,849	6,344	6,978	6,579	5,519	8,458	6,782	4,840	5,060	4,515	6,784	6,540	75,922

Where and How Table 3 Values Were Obtained

The cost of utilities at Southern Methodist University, Dallas, Texas, is given in Table 3. A summary of the cost of four major items for the teaching buildings only is included. Where and how the data were obtained is explained in the following notes which are numbered in accordance with comparable entries in Table 3.

A. *Gas and Steam*

1) Total gas used: from monthly bills of the local gas utility.
2) Total steam generated, thousands of pounds: from SMU steam flowmeter readings.
3) Pounds of steam generated per cu ft of gas: by dividing item 2 by item 1.
4) Total cost of gas: from local utility company bills.
5) Unit cost of gas, cents per thousand cu ft: item 4 divided by item 1.
6) Unit cost of steam for gas only, cents per thousand pounds: obtained by dividing item 4 by item 2.
7) Steam used for air conditioning, thousands of pounds: from steam flowmeters to turbines.
8) Cost of steam for air conditioning: item 7 multiplied by item 6.
9) Total steam sold to dormitories, etc., thousands of pounds: from utility report.
10) Money received for steam sold: from utility report.
11) Steam used for teaching buildings, thousands of pounds: item 9 and item 7 subtracted from item 2.
12) Operating labor chargeable to heating: prorated part of total boiler room labor.
13) Estimated cost of oil for emergency: based on actual use.
14) Net cost of steam for teaching buildings, fuel only: obtained by subtracting items 10 and 8 from items 5 and 13.
15) Total cost for heating teaching buildings: item 14 plus item 12.

B. *Electricity*

1) Total KWH purchased from local utility.
2) Total cost of KWH purchased from local utility.
3) Unit cost, cents per KWH: item 2 divided by item 1.
4) Total KWH sold to dormitories, etc.: from utility report.
5) Money received for KWH sold to dormitories, etc.: from utility report.
6) KWH used for air conditioning: from plant meters.
7) Cost of KWH used for air conditioning: item 6 multiplied by item 3.
8) KWH used for teaching buildings: item 6 plus item 4 subtracted from item 1.
9) Net cost of KWH used for teaching buildings: item 7 plus item 5 subtracted from item 2.

C. *Water*

1) Total gallons used: from local utility bills.
2) Total cost of water, including sewer: from local utility bills.
3) Total gallons sold to dormitories, etc.: from utility report.
4) Money received for water sold to dormitories, etc.: from utility report.
5) Net cost of water for teaching buildings: item 4 subtracted from item 2.

D. *Air Conditioning*

a. *Electricity*

1) Total ton hours produced: from plant meters.
2) Ton hours produced by electric units: from plant meters.
3) KWH per ton hour by electric units: item 6, part B divided by item 2.
4) Unit cost of electricity, cents per KWH: item 3 part B.
5) Unit cost, cents per ton hour, electric unit only: item 4 multiplied by item 3.

b. *Steam*

1) Ton hours produced by steam: from plant meters.
2) Pounds of steam used for air conditioning: from plant steam flowmeter.
3) Pounds of steam per ton hour: item 2 divided by item 1.
4) Unit cost of steam, cents per thousand pounds: item 6, part A.
5) Unit cost, cents per ton hour, steam only: item 4 multiplied by item 3.

E. *Production Cost — Air Conditioning*

1) Cost for electric refrigeration units: item 5, part D-a multiplied by item 2, part D-a.
2) Electric auxiliaries: metered with plant watthour meter.
3) Cost for steam refrigerating units: item 5, part D-b multiplied by item 1, part D-b.
4) Cost of electric auxiliaries for steam units: metered with plant watthour meter.
5) Operating labor chargeable to air conditioning: prorated part of total operating labor.
6) Miscellaneous services and supplies: estimated.
7) Total cost of air conditioning, dollars: sum of items 1 through 6.
8) Unit cost of air conditioning, cents per ton hour: item 7 divided by item 1, part D-a.
9) Income from dormitories, etc.: from utility report.
10) Net cost of air conditioning for teaching: item 9 subtracted from item 7.

F. *Summary*

1) Heat and hot water: item 15, part A.
2) Electricity: item 9, part B.
3) Water: item 5, part C.
4) Air conditioning: item 10, part E.
5) Total: sum of items 1 through 4.

TABLE 4 — SUMMARY OF UNIT COSTS for heating, air conditioning, and power for lights and auxiliaries at SMU based upon 12 month study ending June 30, 1961

Air Conditioning		
Teaching buildings only		
1) Net cost for 12 months, $	22,200	
2) Area of 12 buildings served, sq ft	511,714	
3) Unit cost, ¢/sq ft/yr		4.33[1]
All buildings		
1) Net cost for 12 months, $	48,619	
2) Area served (exclusive of Coliseum), sq ft	878,495	
3) Unit cost, ¢/sq ft/yr		5.53[1]
Heating		
Teaching buildings only		
1) Net cost for 12 months, $	21,446	
2) Area of 12 buildings served, sq ft	830,685	
3) Unit cost, ¢/sq ft/yr		2.58[1]
All Buildings		
1) Net cost for 12 months, $	51,286	
2) Area served (exclusive of ½ of Coliseum), sq ft	1,477,366	
3) Unit cost, ¢/sq ft/yr		3.47[1]
Electricity for lights and power (other than refrigeration for air conditioning)		
1) Total cost of KWH purchased, $	115,800	
2) Cost of KWH for air conditioning, $	9,789	
3) Net cost of electricity, $	106,011	
4) Area served (exclusive of ½ Coliseum), sq ft	1,477,366	
5) Unit cost (including lights, pumps, fans, etc), ¢/sq ft/yr		7.17[1]

[1]*Unit costs are based on local electrical energy and/or natural gas rates at Dallas, Texas. Application of data to other areas must take differences in energy costs and severity of weather into account.*

termination of the cost of operating the teaching buildings.

The Chilled Water Pumping System

As noted in Table 1, three primary chilled water circuits serve the air conditioning load. The largest of these, called the west circuit, has a connected load of 1,749 tons on week days. The second largest, the north circuit, has a connected load of 1020 tons. The south circuit has a connected load of 464 tons without the Coliseum and a maximum connected load of 1,664 tons when the Coliseum is cooled.

The characteristics of the system's five chilled water pumps are shown in Figs. 1, 2, and 3. Fig. 1 shows the individual head-capacity curves for each pump. Since pumps 0 and 2 are similar, and pumps 3 and 4 are the same type, three curves provide the characteristics of the five chilled water pumps. In normal operation, these pumps are operated in parallel, using various combinations as necessary to pump the required amount of water to satisfy the air conditioning load.

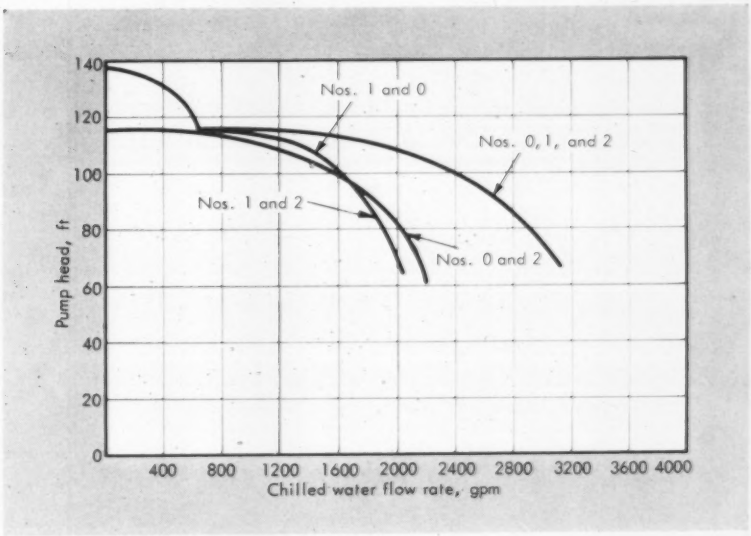
Fig. 2 shows various combinations of pumps 0, 1, and 2 which serve the electric motor driven condensing units. These curves are self-explanatory as they show various combinations of the three pumps operating in parallel.

Fig. 3 shows various combinations of the pumps serving the electric and steam water chillers. One curve is for pumps 0, 3, and 4 operating in parallel (one electric unit and two steam turbine units operating). Another shows pumps 0, 1, 3, and 4 operating in parallel (two electric units and two steam turbine units). The third curve shows the characteristic of all five pumps operating in parallel.

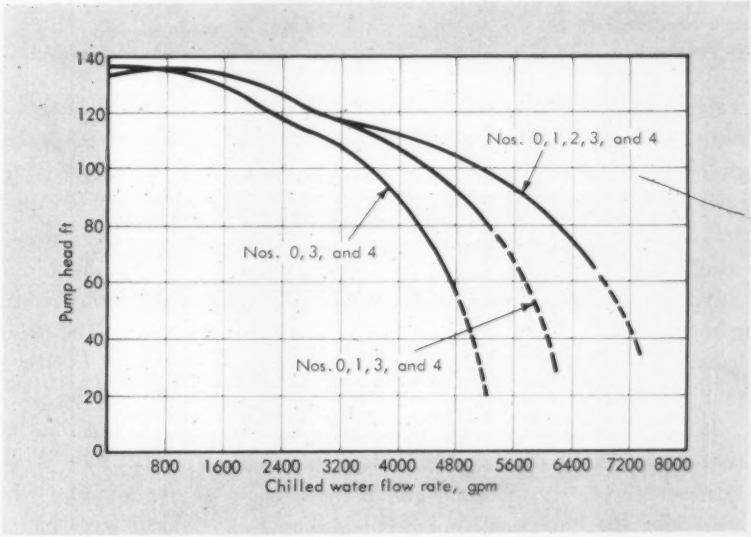
Operating Procedure

With the present load, normal procedure from Monday through Friday is to operate both steam units from 7:00 am to 10:30 or 11:00 pm. At 11:00 pm when both steam units are shut down, one electric driven unit is operated to take care of the dormitory load until 7:00 am when both steam units are put back on the line.

The system was designed to circulate 1.5



2 COMBINED CHARACTERISTICS of pumps serving the motor driven chillers when operated in various parallel combinations to meet load requirements are shown here

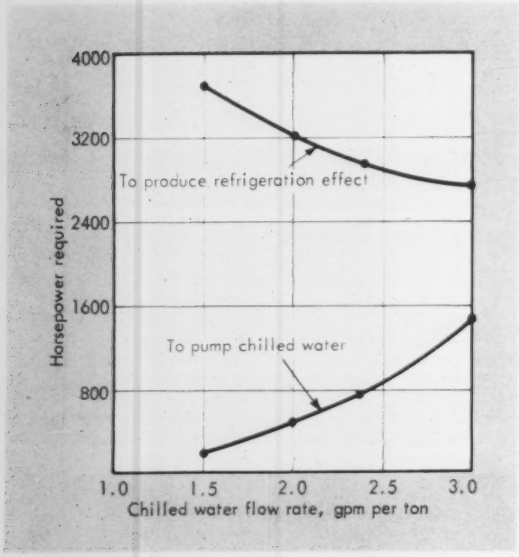


3 PUMP CHARACTERISTICS for various parallel combinations of the pumps serving the motor and turbine driven units are plotted here

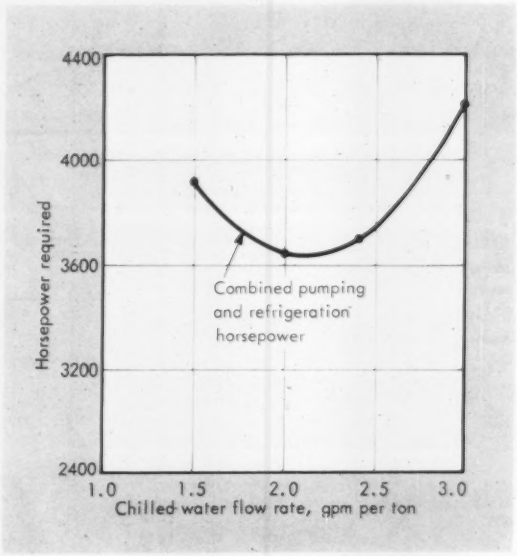
gpm per ton of 36 F water with a temperature rise of 18 deg F giving a return water temperature of 54 F. Each building has a secondary chilled water pump and a thermostatically controlled three-way mixing valve, which proportions and mixes recirculated water from the building with primary chilled water from the main to give the desired temperature to supply the coils. The coils are designed for a temperature rise of 8 deg F, which corresponds to a flow of 3 gpm per ton. The thermostatically controlled three way valve in each building is adjusted to suit local conditions, which in most cases are 44 to 46 F supply chilled water temperature.

Selection of Optimum Pumping Rate

Fig. 4 shows the horsepower required for pumping chilled water on the campus in quantities ranging from 1.5 to 3 gpm per ton. The horsepower required to produce chilled water at temperatures corresponding to the water flow rate is also plotted on Fig. 4. Note that refrigeration horsepower decreases with increased water flow. For the present design, based on a chilled water flow of 1.5 gpm per ton, (chilled



4 HORSEPOWER required for pumping chilled water and for producing refrigeration effect at various system flow rates is shown here. Compressor horsepower decreases with increased flow because supply water temperature can be increased



5 COMBINED HORSEPOWER curve, which is sum of the two curves in Fig. 4 shows optimum water flow rate from power standpoint is 2 gpm per ton in this system. Although system was designed to circulate 1.5 gpm per ton, it is operated at 2 gpm per ton to save power

water supply at 36 F) the horsepower required for the refrigerating plant is 3700 hp. If the chilled water flow was increased to 3 gpm per ton, chilled water could be produced at 46 F and the horsepower required for the refrigerating plant would be 2750 hp. From the pump curve at 1.5 gpm per ton, 200 hp is required for pumping. If the flow rate was increased to 3 gpm per ton, 1450 hp would be required for pumping.

It is apparent from a study of these two curves that some optimum flow exists where the total horsepower for refrigeration and pumping is a minimum. Fig. 5 gives a combined pumping and refrigerating horsepower curve which shows the optimum flow to be about 2 gpm per ton, which corresponds to a 12 deg F water temperature rise. The plant is operated at this flow rate. Chilled water is supplied at approximately 40 F and returns to the central plant at approximately 52 F.

How Chilled Water Is Metered

In the early development of air conditioning on the SMU campus, an attempt was made to meter refrigerating effect by means of a recording flowmeter with two temperature pens. This method is still used in one or two places, but it is not satisfactory.

At present, a Btu meter consisting of a mechanical means for integrating the product of flow and temperature difference is used. These meters have one register indicating water flow in gallons, and a second register indicating ton hours. The principle of this meter is that a disc rotated from a flow meter turns a wheel on the top of the disc. The wheel is positioned at a radius proportional to the temperature difference. This is a mechanical action which moves the rotating wheel away from the center of the disc with increasing temperature difference so that the revolutions made by the small wheel are proportional to the product of the rate of flow and the temperature difference. By applying the correct multiplier the meter is made to read directly in ton hours.

The Btu meters in the plant range in size from 8 to 12 in. and cost approximately $1,000 each. The flowmeter section can either be an orifice meter or a propeller type water meter. The orifice meters are usually less expensive but cannot be applied unless the piping includes a good straight run in which the orifice can be installed. The complete Btu meter consists of a flowmeter and a totalizing Btu meter.

Tables for Calculating Weights of Sheet Metal Ducts

By WILLIE HAMMER
Mechanical Engineer

THE FOLLOWING TABLES, plus others to be published as succeeding Data Sheets, will allow the engineer to read directly the weight, in lb per lineal ft, of galvanized iron ducts up to 102 in. in size.

The Tables have been prepared for low pressure systems using galvanized iron in gages as recommended by the American Society of Heating, Refrigerating and Air-Conditioning Engineers *Guide*.

Each Weight Table is followed by a Table of conversion factors by which to multiply a given weight value when different gages of metal will be used, or for different materials (black iron, aluminum), either for medium or high pressure systems or when special rigidity is required. ≠

TABLE 1 — WEIGHTS OF RECTANGULAR GALVANIZED IRON DUCTS (lb per lineal ft) for duct sizes 3 in. by 3 in. to 12 in. by 12 in., 26 gage U. S. Std (0.906 lb per sq ft). Add 15 percent to given weights to cover seams, connectors, slips, scrap, and duct end closing pieces. Bracing and stiffening should be calculated separately

Sides (in.)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	7.0	8.0	9.0	10.0	11.0	12.0
3.0	0.91	0.98	1.06	1.13	1.21	1.28	1.36	1.51	1.66	1.81	1.96	2.11	2.27
3.5	0.98	1.06	1.13	1.21	1.28	1.36	1.43	1.59	1.74	1.89	2.04	2.19	2.34
4.0	1.06	1.13	1.21	1.28	1.36	1.43	1.51	1.66	1.81	1.96	2.11	2.27	2.42
4.5	1.13	1.21	1.28	1.36	1.43	1.51	1.59	1.74	1.89	2.04	2.19	2.34	2.49
5.0	1.21	1.28	1.36	1.43	1.51	1.59	1.66	1.81	1.96	2.11	2.27	2.42	2.57
5.5	1.28	1.36	1.43	1.51	1.59	1.66	1.74	1.89	2.04	2.19	2.34	2.49	2.64
6.0	1.36	1.43	1.51	1.59	1.66	1.74	1.81	1.96	2.11	2.27	2.42	2.57	2.72
7.0	1.51	1.59	1.66	1.74	1.81	1.89	1.96	2.11	2.27	2.42	2.57	2.72	2.87
8.0	1.66	1.74	1.81	1.89	1.96	2.04	2.11	2.27	2.42	2.57	2.72	2.87	3.02
9.0	1.81	1.89	1.96	2.04	2.11	2.19	2.27	2.42	2.57	2.72	2.87	3.02	3.17
10.0	1.96	2.04	2.11	2.19	2.27	2.34	2.42	2.57	2.72	2.87	3.02	3.17	3.32
11.0	2.11	2.19	2.27	2.34	2.42	2.49	2.57	2.72	2.87	3.02	3.17	3.32	3.47
12.0	2.27	2.34	2.42	2.49	2.57	2.64	2.72	2.87	3.02	3.17	3.32	3.47	3.62

CONVERSION FACTORS (gages for iron are U. S. Std; for aluminum, Browne & Sharpe)

For	Material	Gage	Lb per sq ft	Factor
Low pressure (to 1-½ in. WG)	Black iron	26	0.750	0.828
	Aluminum	24	0.282	0.311
Medium pressure (1-½ to 4 in. WG)	Galvanized iron	24	1.156	1.276
	Black iron	24	1.000	1.104
Or for special stiffness or rigidity	Aluminum	22	0.353	0.390
High pressure (4 to 8 in. WG)	Galvanized iron	22	1.406	1.552
	Black iron	22	1.250	1.380

HPAC DATA SHEET

TABLE 2 — WEIGHTS OF RECTANGULAR GALVANIZED IRON DUCTS (lb per lineal ft) for duct sizes 4 in. by 13 in. to 30 in. by 30 in., 24 gage U. S. Std (1.156 lb per sq ft). Add 15 percent to given weights to cover seams, connectors, hangers, slips, scrap, and duct end closings. Bracing and stiffening should be calculated separately

Sides (in.)	13	14	15	16	18	20	22	24	26	28	30
4	3.28	3.47	3.66	3.85	4.24	4.62	5.01	5.40	5.78	6.17	6.55
5	3.47	3.66	3.85	4.05	4.43	4.82	5.20	5.59	5.97	6.36	6.74
6	3.66	3.85	4.05	4.24	4.62	5.01	5.40	5.78	6.17	6.55	6.94
7	3.85	4.05	4.24	4.43	4.82	5.20	5.59	5.97	6.36	6.74	7.13
8	4.05	4.24	4.43	4.62	5.01	5.40	5.78	6.17	6.55	6.94	7.32
9	4.24	4.43	4.62	4.82	5.20	5.59	5.97	6.36	6.74	7.13	7.52
10	4.43	4.62	4.82	5.01	5.40	5.78	6.17	6.55	6.94	7.32	7.71
11	4.62	4.82	5.01	5.20	5.59	5.97	6.36	6.74	7.13	7.52	7.90
12	4.82	5.01	5.20	5.40	5.78	6.17	6.55	6.94	7.32	7.71	8.09
13	5.01	5.20	5.40	5.59	5.97	6.36	6.74	7.13	7.52	7.90	8.29
14	5.20	5.40	5.59	5.78	6.17	6.55	6.94	7.32	7.71	8.09	8.48
15	5.40	5.59	5.78	5.97	6.36	6.74	7.13	7.52	7.90	8.29	8.67
16	5.59	5.78	5.97	6.17	6.55	6.94	7.32	7.71	8.09	8.48	8.86
18	5.97	6.17	6.36	6.55	6.94	7.32	7.71	8.09	8.48	8.86	9.25
20	6.36	6.55	6.74	6.94	7.32	7.71	8.09	8.48	8.86	9.25	9.64
22	6.74	6.94	7.13	7.32	7.71	8.09	8.48	8.86	9.25	9.64	10.0
24	7.13	7.32	7.52	7.71	8.09	8.48	8.86	9.25	9.64	10.0	10.4
26	7.52	7.71	7.90	8.09	8.48	8.86	9.25	9.64	10.0	10.4	10.8
28	7.90	8.09	8.29	8.48	8.86	9.25	9.64	10.0	10.4	10.8	11.2
30	8.29	8.48	8.67	8.86	9.25	9.64	10.0	10.4	10.8	11.2	11.6

CONVERSION FACTORS (gages for iron are U. S. Std; for aluminum, Browne & Sharpe)

For	Material	Gage	Lb per sq ft	Factor
Low pressure (to 1-½ in. WG)	Black iron	24	1.000	0.865
	Aluminum	22	0.353	0.305
Medium pressure (1-½ to 4 in. WG)	Galvanized iron	22	1.406	1.216
	Black iron	22	1.250	1.081
Or for special stiffness or rigidity	Aluminum	20	0.452	0.391
High pressure (4 to 8 in. WG)	Galvanized iron	20	1.656	1.432
	Black iron	20	1.500	1.298

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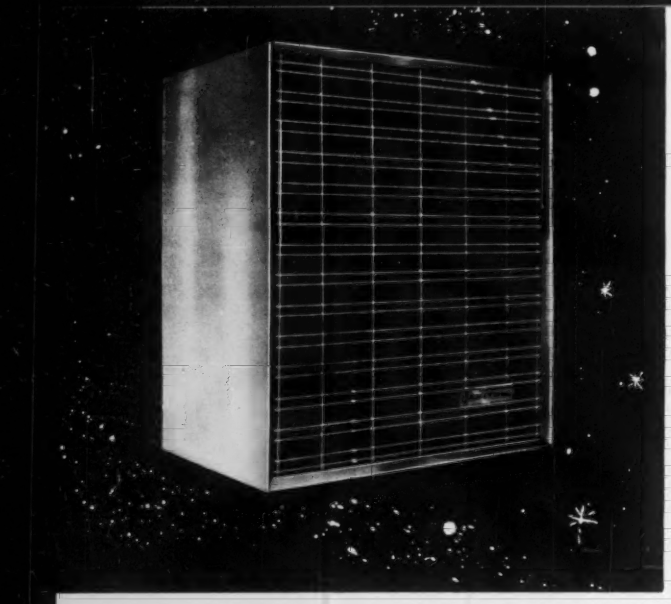

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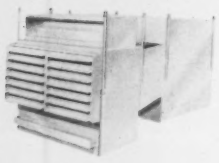

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Allows air delivery from greater heights and against greater static pressures. Models with exposed or enclosed blowers. A.G.A. approved as low and high static-type blower unit heater for air delivery to duct system up to 1.0 in. W.C. external static. Heat sections factory assembled. Sizes: 300,000, 400,000 and 500,000 Btu/hr. input.

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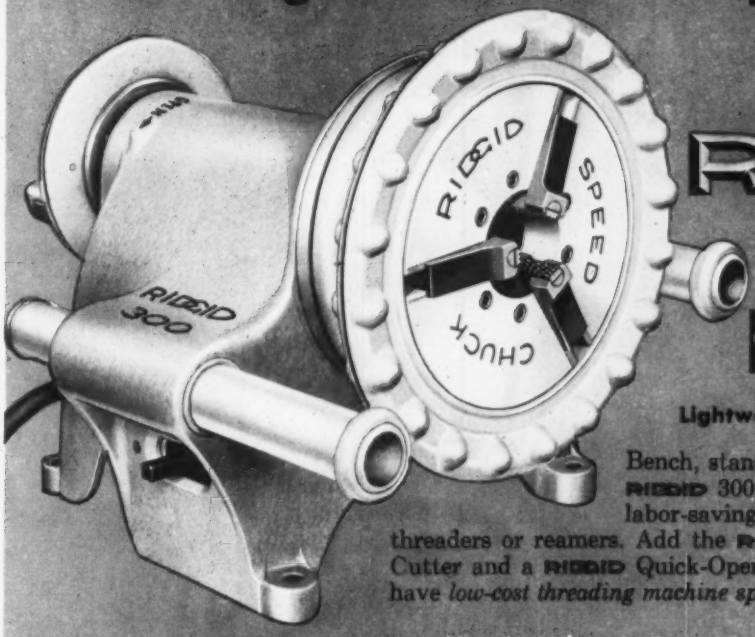
Also Makers of Surface Industrial Furnaces, Kathabar Humidity Conditioning, Janitrol Residential Heating and Cooling Equipment.

Time-Saving Power For Your Shop or on the Job...



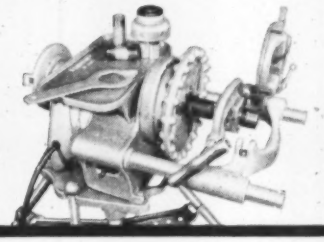
New RIDGID 300 Power Drive

Lightweight • Versatile • Low In Price

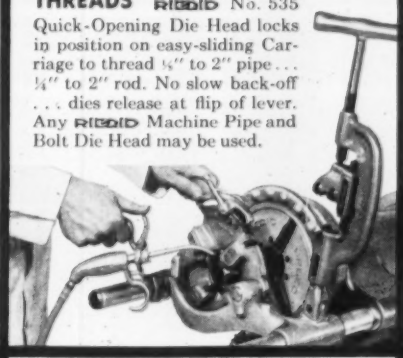
Bench, stand or truck mounted, this compact RIDGID 300 Power Drive gives you time and labor-saving power for your hand cutters, threaders or reamers. Add the RIDGID No. 310 Carriage, No. 360 Cutter and a RIDGID Quick-Opening Machine Die Head, and you have *low-cost threading machine speed and ease!*

Here's What it Does!

CUTS RIDGID No. 360 Cutter, shown here, cuts ⅛" to 2" pipe and conduit — up to ⅝" rod. Extra-wide rolls keep cutter straight for perfect high-speed tracking. Cutter stays back out-of-way when not in use.



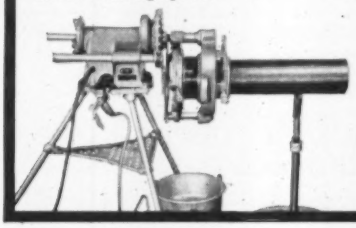
THREADS RIDGID No. 535 Quick-Opening Die Head locks in position on easy-sliding Carriage to thread ⅛" to 2" pipe... ¼" to 2" rod. No slow back-off ... dies release at flip of lever. Any RIDGID Machine Pipe and Bolt Die Head may be used.



REAMS 300 Power Drive does all the work. Heat treated cutting edges of RIDGID "LonGrip" Reamer won't dig in . . . produce smooth pipe or conduit walls in seconds.

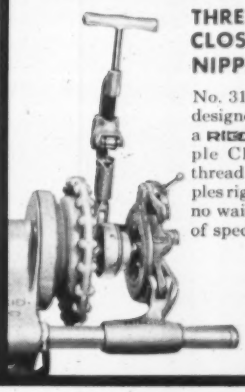
DRIVES GEARED THREADERS

Compact, RIDGID No. 300 Power Drive has plenty of power for up to 12½ geared tools. New RIDGID Close-Coupled drive shown here, for Nos. 141 and 161 Jam-Proof Threaders eliminates Universal Drive Shaft . . . saves working space.



THREADS CLOSE NIPPLES

No. 310 Carriage is so designed that by using a RIDGID No. 19 Nipple Chuck you can thread even close nipples right on the job... no waiting for nipples of special lengths.

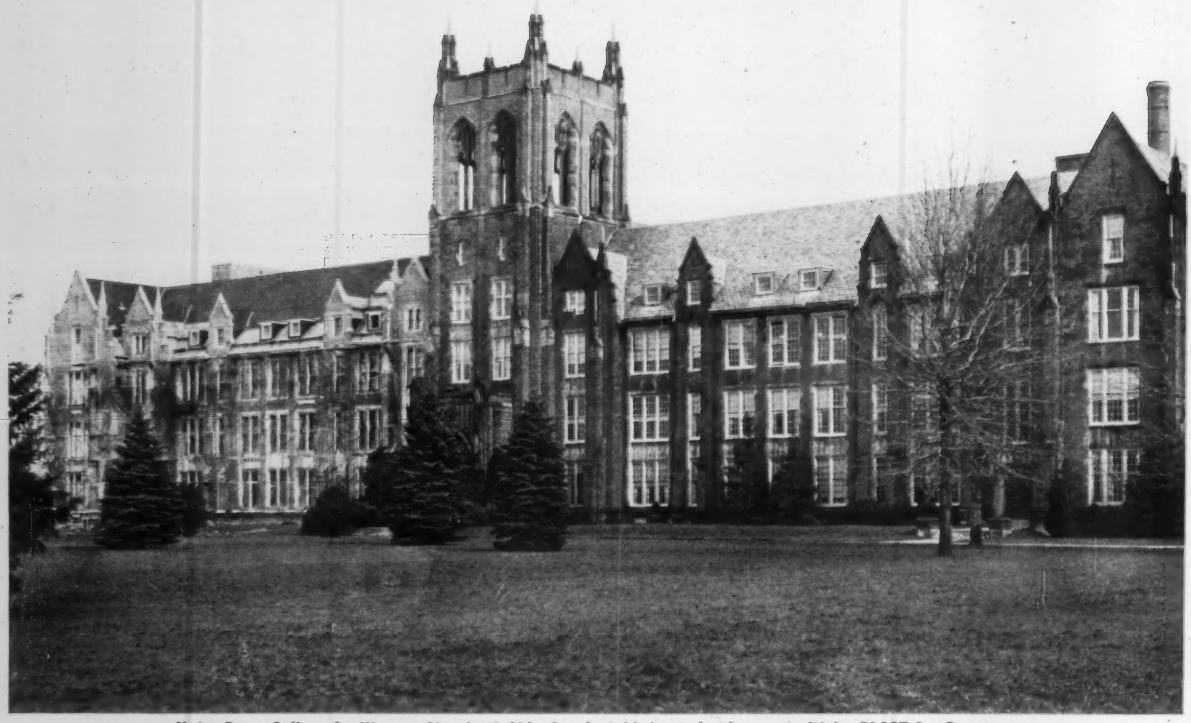


AND IS EASY TO MOVE With the aid of the Transporter, one man can easily move a RIDGID 300 Power Drive with its No. 1206 Folding Stand attached. Set-up is fast and easy. Stand's integral tool tray locks legs in position, forming rigid work base.

Save Time and Increase Your Profits on Every Job. See and Try This Biggest "Threading Machine" Bargain at your Supply House!

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.

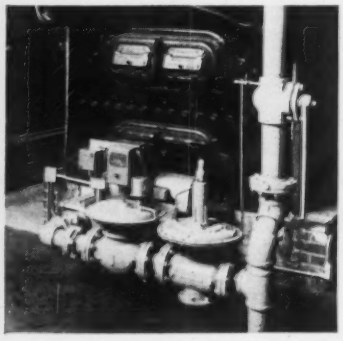


Notre Dame College for Women, Cleveland, Ohio. Comfortably heated at low cost with Lo-BLAST Gas Burners.

Saves $2,000 a year on fuel costs, heating with LO-BLAST GAS burners

"Five years ago we converted to gas with Lo-BLAST Gas Burners to fire the boilers for our heating system. Since then we have saved at least $2,000 a year on fuel costs alone," says Bernard Muhle, Building Superintendent at Notre Dame College for Women. "On cool mornings in Fall and Spring, this gas equipment gives us quick heat for short periods, without wasting fuel on long warm-ups."

You save on maintenance and installation, too, with versatile Lo-BLAST Gas Burners. They adapt easily to any boiler or furnace. All components are outside the firebox for easy access. The *gas*-fired burners operate automatically with forced air injection, independently of variable chimney drafts. You get greater combustion efficiency with all the convenience, safety, dependability and economy of modern gas heating.



The Lo-BLAST Gas Burners (foreground) which fire these boilers at Notre Dame College for Women, can generate 3 pounds of steam pressure within 5 minutes. No long, costly warm-up. Economite and Lo-BLAST Gas Burners are available in capacities from 70,000 to 20,000,000 BTU p/h.

For information on Lo-BLAST Gas Burners – and their small counterpart, the Economite – contact your local Gas Company, or write to Mid-Continent Metal Products Company, 2717 Greenview Avenue, Chicago 14, Illinois.

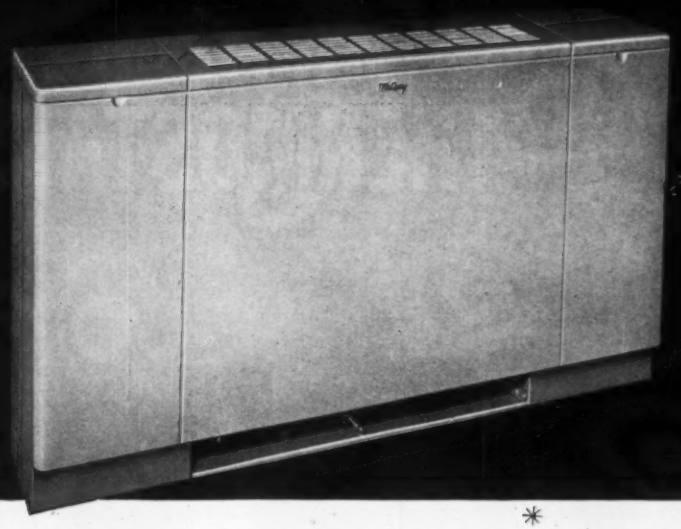
American Gas Association

FOR HEATING...GAS IS GOOD BUSINESS!

BUILT-IN QUALITY
BUILT-IN PERFORMANCE

with

individual room

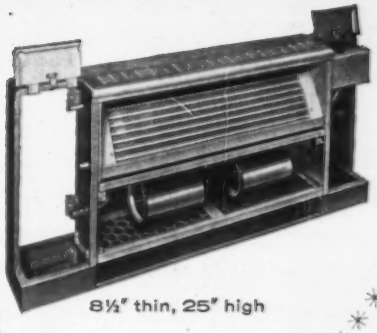


NOW 4
MODELS

220 to 1240 CFM

Extra large piping compartments, 8½" thin design, complete slide-out fan deck assembly, motor disconnect plug, field reversible coils, full rated capacity and day-to-day quiet, efficient operation . . . these are but a few of the many reasons why so many engineers, contractors and building operators are specifying and installing McQuay thin-line design, individual room Seasonmakers.

Availability in four types and seven sizes and faster, easier installation make them preferred for apartments, hotels, motels, offices or any installation utilizing a central station heating and cooling system. Hideaway and ceiling models range from 220 to 640 cfm. Floor and basic models from 220 to 1240 cfm. Contact your local McQuay representative, or write McQuay, Inc., 1601 Broadway Street N. E., Minneapolis 13, Minnesota for detailed specifications.

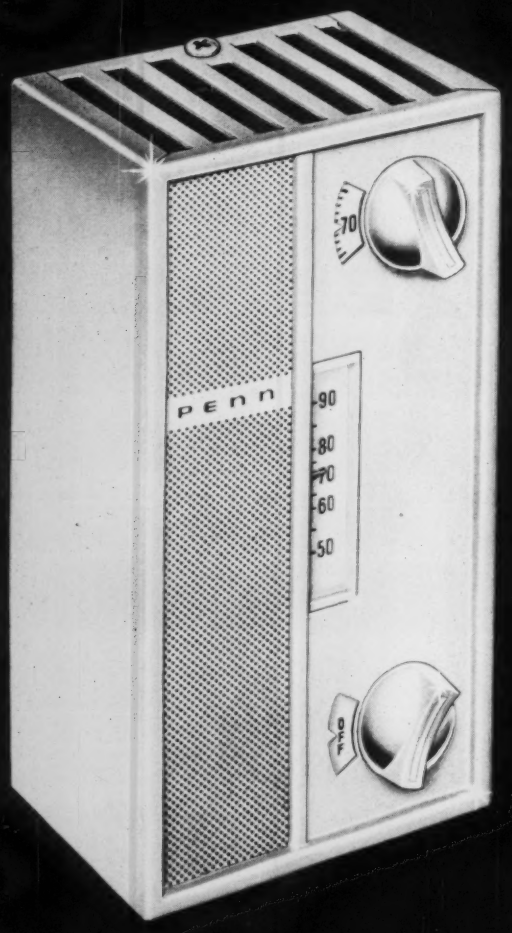


8½" thin, 25" high

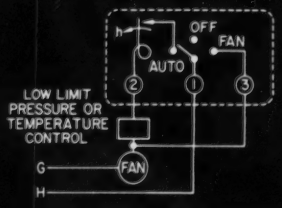
McQuay means Quality

McQuay INC.

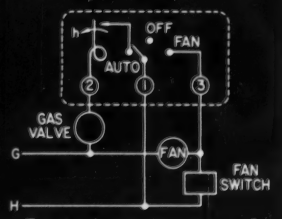
AIR CONDITIONING • HEATING • REFRIGERATION



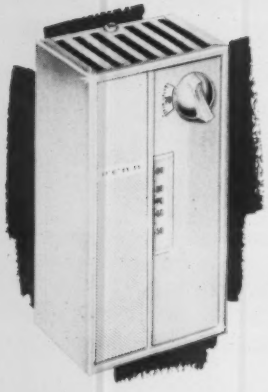
NEW UNIT HEATER THERMOSTAT



Typical application of Type 822A7 with AUTO-OFF-FAN selector on steam or hot water coil unit.



Typical application of Type 822A7 with AUTO-OFF-FAN selector on gas-fired unit heater.



Series 822, with or without function selector knob, rated for ¼ hp. service. Series 824, without function selector, is rated for 1 hp. service.

features easy-to-use, locking-type knobs for heating and summer ventilation

Here's the modern line-voltage thermostat with beautiful "slim-line" styling. Its built-in AUTO-OFF-FAN selector assures year 'round efficiency of unit heaters . . . saves fuel in winter . . . provides ventilation in summer.

It has easy-to-read temperature and function selector dials. It has exclusive, locking-type adjusting knobs, attached to cover but connected to adjusting shafts by factory-installed "keys" within the knobs. It has a built-in, concealed adjustable high limit stop for temperature dial. It has low operating differential at all voltages and amperages within its rating. It has easiest field wiring ever . . . simply connect to large terminals *on back of thermostat*. And, it has many more features you'll want. Learn more about this better thermostat for unit heaters . . . write to the Penn factory.

PENN CONTROLS, INC. Goshen, Indiana

EXPORT DIVISION: 27 E. 38th ST., NEW YORK, N.Y.

AUTOMATIC CONTROLS FOR HEATING, REFRIGERATION, AIR CONDITIONING, APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

all GAS...all NESBITT...all YOURS

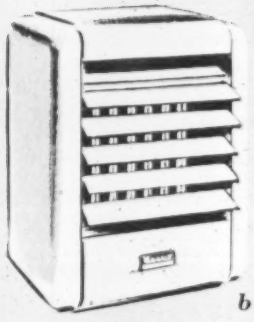
From your Nesbitt Wholesaler

Including the New Gas-fired

Sealed Flame Overhead Heater

a

With the addition of Sealed/Flame units to the Nesbitt line, you now have a variety of gas-fired units to meet every type of installation where the use of gas is indicated — propeller-fan, blower-fan, duct-furnace, new horizontal-furnace, and sealed combustion heaters. The Nesbitt Sealed/Flame Unit Heater draws all the air needed for heating from outside the building — through an inlet pipe; and it vents to the outside, under pressure, all the exhaust gases. Its full circle of clean heat (radial-flow or down-blow) is ideally suited to situations where other types of unit heaters cannot be employed.



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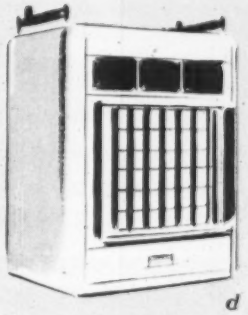


d

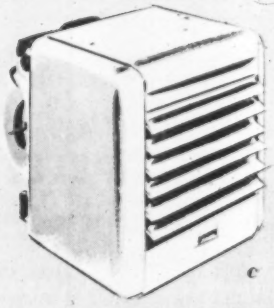
Send for any of these publications

a **Sealed/Flame Unit Heaters.** Two sizes: 1,000 and 1,250 cfm; 85,000 and 115,000 Btu/hr input; 360-degree discharge; Radial-Flo and Down-Blo models; publication 400-4.

b **Propeller Fan Unit Heaters.** Ten sizes: 400 to 3,600 cfm; 25,000 to 250,000 Btu/hr input; lightweight, compact, sound-code rated; publication 400-1.

c **Blower Fan Unit Heaters.** Eight basic sizes: 820 to 3,360 cfm; 50,000 to 250,000 Btu/hr input; quiet operating; for free delivery or with ducts; publication 400-2.

d **Duct Furnace.** Six basic sizes: 1,110 to 4,450 cfm; 80,000 to 250,000 Btu/hr input; for use with air conditioning units or with custom ductwork; publication 400-3.



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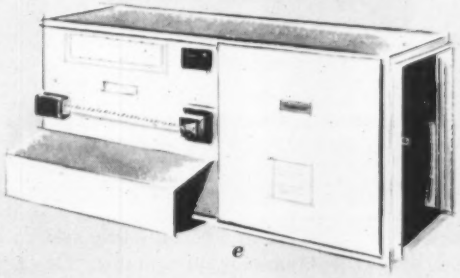


e

e **Horizontal Furnace.** Five sizes: 600 to 1,850 standard cfm (0 to ½" static pressure); 1,000 to 2,350 high cfm; 70 to 140 MBH input; for use as a forced-air furnace, a unit heater, or with cooling unit; pub. 400-5.

If your wholesaler does not stock Nesbitt Unit Heaters, report him to us!

Nesbitt *THE NAME TO GO BUY IN UNIT HEATERS*

Gas-Fired, Steam, Hot Water and Electric

SOLD THROUGH MANY OF THE FINEST WHOLESALERS

Made by John J. Nesbitt, Inc., Philadelphia 36, Pa. **Basic Ingredient: EXCELLENCE**

CLOGGING by high wet-strength paper products is IMPOSSIBLE!

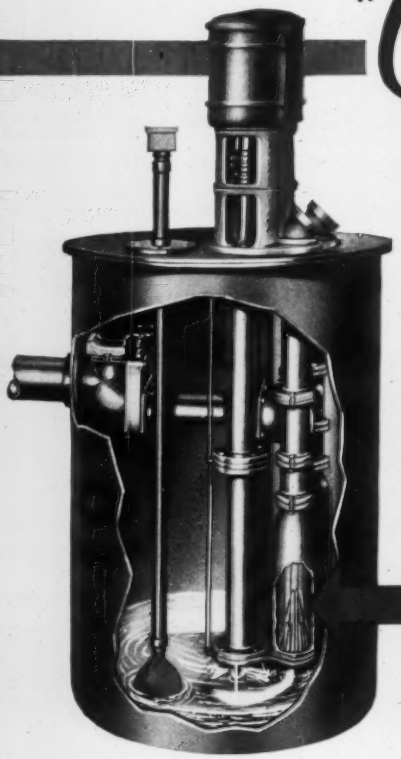
with the new FLUSH KLEEN® system from "Chicago"

This clogging cannot happen with the FLUSH KLEEN System

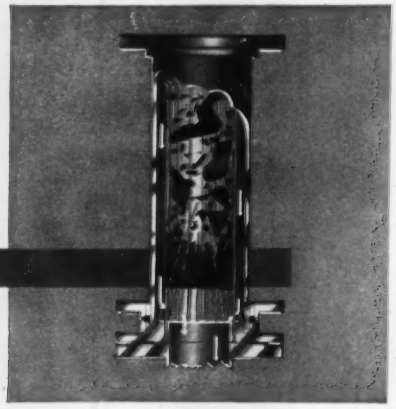
CLOGGED— Paper toweling piled up at eye of 2½" sphere design impeller.

CLOGGED— Complete clogging of 2½" sphere design impeller.

CLOGGED— Complete clogging of 3" sphere non-clog impeller.



THE FLO-THRU STRAINER, heart of the Flush Kleen system continuously permits only clear liquid to flow through the strainer into the pump at highest solids loadings.



SOLIDS NEVER REACH THE IMPELLER

Impeller handles only clear liquid. Shaft, bearings and motor are never subjected to severe strain and wear due to partially or completely clogged impellers. The life of a Flush Kleen system is therefore much longer than that of so-called non-clog type pumps. "Down time" due to clogging is eliminated and a quiet, smooth operating unit is assured.

For further information see your local Chicago Pump distributor or write Chicago Pump for Bulletin 122-D.

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FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION

CHICAGO PUMP

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This is more than just a brochure. It's a complete working handbook, with everything you need to select and order the *exact* unit or combination of units required to do your job most efficiently and economically.

Includes such information as:

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- FAN AND COIL PERFORMANCE
- PHOTOGRAPHS, CHARTS, DIAGRAMS, Etc.

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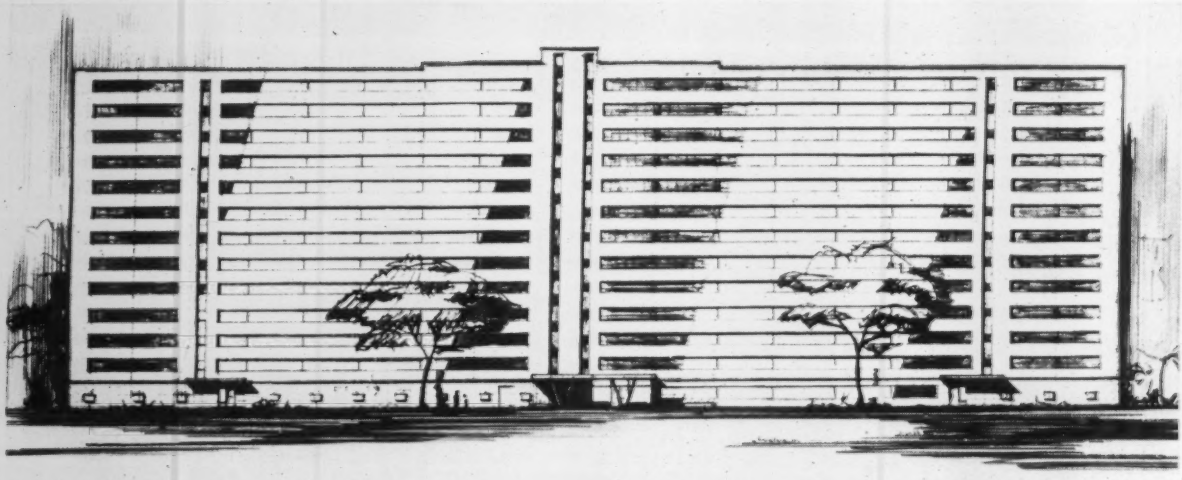
Largest apartment
ever to be built
in Cleveland...



New Terrace Park Apartments becomes Cleveland's largest apartment. Marvin Helf, Inc., developer and general contractor. Spohn Heating and Ventilating Company, mechanical contractor. Keeva Kekst, architect.

Spohn installs the low-cost pipe for waste lines, vents, heating and air conditioning piping

Good for the life of the building, steel pipe was used extensively in Cleveland's beautiful new Terrace Park Apartments. This 13-story beauty—a Marvin Helf, Inc., development—will contain 255 suites. Specified on the basis of overall savings, steel pipe was installed by Spohn Heating and Ventilating Company.

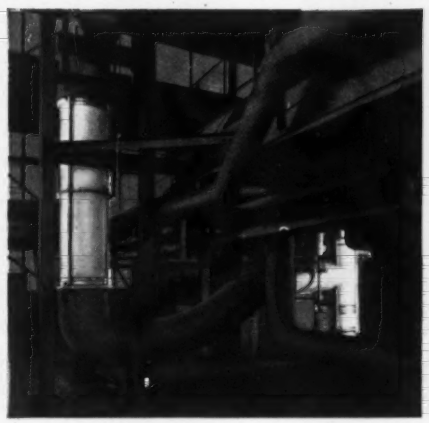
To save you time on the job, Republic makes every effort to produce pipe of the highest attainable quality. If it's galvanized, for example, you will find that every inch *is* galvanized, *is* welded, *is* sound, *is* round, *is* ready for installation. Contact your Republic distributor or call the nearest Republic sales office. You will receive quotes and confirmation within the day, perhaps within the hour. Republic sales offices are located in all principal cities. *Republic Steel Corporation, Department HP-2416, 1441 Republic Building, Cleveland 1, Ohio.*

Steel
Strong
Modern
Dependable

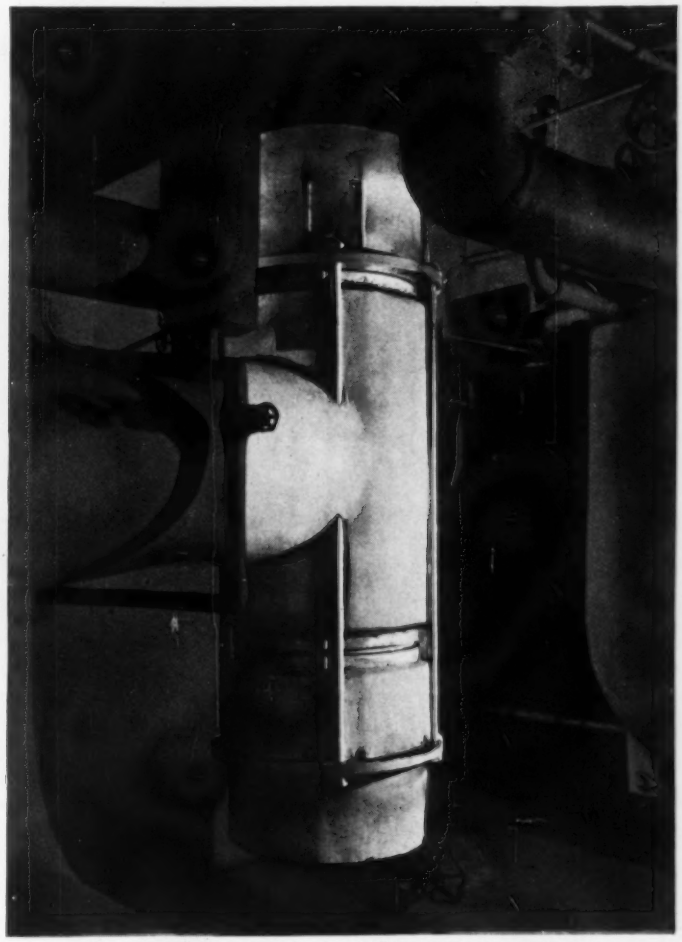
CALL FOR REPUBLIC PIPE

...MADE AND BACKED BY AMERICANS

REPUBLIC STEEL



In the foreground, a 20" ZALLEA Universal Expansion Joint absorbing lateral movement.



At a major Eastern oil refinery, a 20" Zallea Pressure Balanced Expansion Joint installed on a steam turbine exhaust nozzle.

it's ZALLEA for maximum reliability... the tough jobs show why

Six tough Zallea Expansion Joints protect three 10,000 kw turbine generators from the wallop of thermal stresses . . . real hot-spot duty. Each generating unit has a 20" pressure balanced, self equalizing expansion joint installed at the turbine exhaust nozzle to absorb reaction load due to internal pressure acting against the turbine casing. A 20" universal expansion joint absorbs lateral deflection in the pipe run from the pressure balanced unit. Temperatures range from 0° to 615° at start-up, back to 475° in operation, at 200 psig. To cope with these cycles, the turbines demand—and get—the maximum reliability of Zallea Expansion Joints.

Whatever the service, none of the many factors affecting Zallea Expansion Joint reliability are left to guesswork. Zallea Expansion Joints are hydraulically formed. Advanced welding techniques insure welds having the same thickness, strength and physical properties as the parent metal. Zallea has done more cyclic testing to destruction than all government agencies and industrial firms combined. Zallea has produced more expansion joints than any other manufacturer . . . offers you more application engineering experience. These are just a few of the reasons Zallea Expansion Joints can and do outlive the equipment they serve. Sooner or later, ordinary expansion joints hand you a bill for unscheduled downtime, lost output.

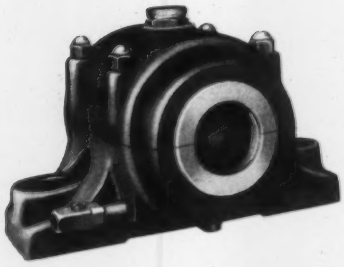
Got a tough one coming up? Call in an experienced Zallea design and application specialist. Knows every inch of his product, can assist with every facet of your problem. And write for catalog 56, Zallea Brothers, Taylor and Locust Streets, Wilmington 99, Delaware.

Zallea

for maximum reliability

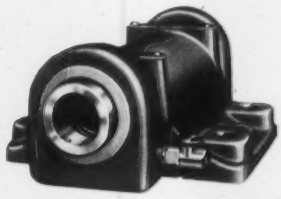
WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS

QUIET



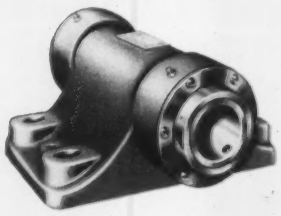
DODGE SLEEVOIL PILLOW BLOCKS

Exceptionally quiet in operation. Noted for superb quality. Plain and Water Cooled Types. Precision-built, ring-oiling, babbitted. Self-aligning. Can be drilled for thermostatic emergency warning. Shaft sizes from 1-7/16″ to 12″.



DODGE BRONZE BUSHED PILLOW BLOCKS

Designed for Arrangement No. 2 installations. Two bronze bushings of high lead content mounted in one cast iron housing. Special T-section rings for dependable lubrication. Exceptionally quiet in operation. Shaft sizes from 15/16″ to 2-3/16″.



DODGE BALL BEARING PILLOW BLOCKS

Designed for Arrangement No. 2 installations. Two precision single row, deep groove ball bearings in one cast iron housing. Extended inner race carries shaft. Remarkable ease of installation and maintenance. Shaft sizes from 15/16″ to 2-3/16″.

These quality bearings have been developed in close cooperation with manufacturers of fan and blower equipment — to meet the highly specialized requirements of this field.

The nation's great generating plants choose these bearings because of their extraordinary dependability—and the extreme quietness of their operation makes them top choice for air conditioning systems in hospitals, schools, theatres, auditoriums.

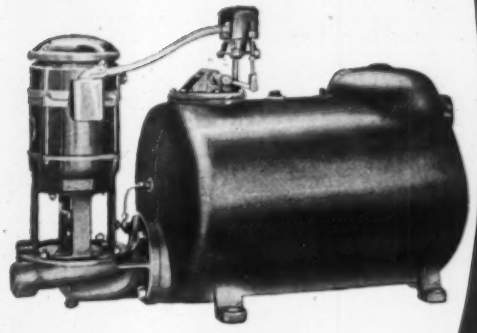
Dodge Fan and Blower Bearings are available from stock—with stock-product economy. Consult your local Dodge Distributor—or write us for technical data.

DODGE MANUFACTURING CORPORATION
1600 Union Street, Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

MANUFACTURER OF AMERICA'S MOST COMPLETE LINE OF MOUNTED BEARINGS

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the white pages of your telephone directory, or in the yellow pages under "Power Transmission Equipment."



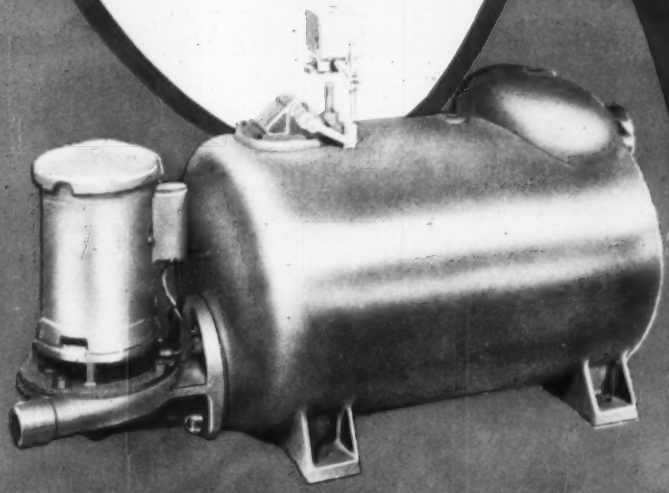
SKIDMORE
TYPE "VC" PUMP

TYPE "VC" PUMP

Always a favorite for smooth dependable operation . . .

NOW!

THE NEW SKIDMORE "VCS" PUMP



SKIDMORE TYPE "VCS" PUMP

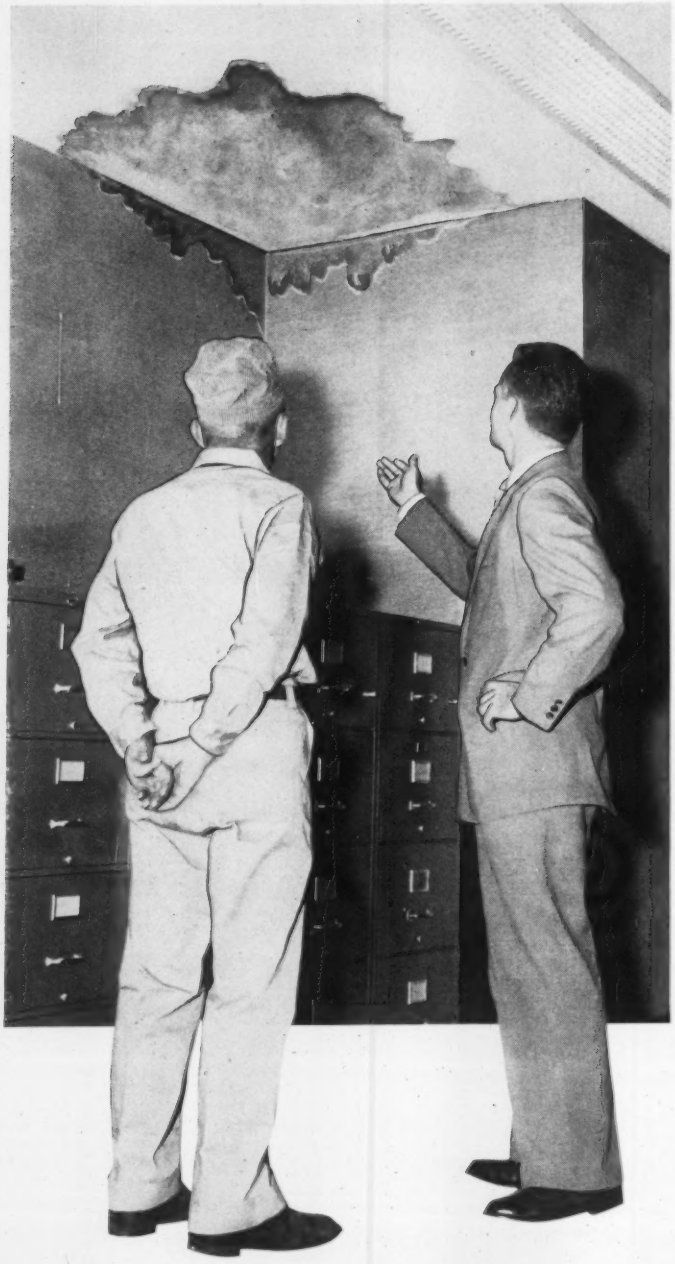
You get much more when you specify a Skidmore heating pump . . . many extra features that go into custom-made installations are standard with a Skidmore pump at no extra cost. You also get quality construction — compact design — ease of maintenance — and quiet operation. Select from a complete line of both horizontal or vertical pumps. Every Skidmore pump is engineered to meet your exacting requirements. See your nearest Skidmore Representative or write for bulletins.

Featuring mechanical shaft-seal and close-coupled design

Write today for Bulletin No. 10-C

SKIDMORE PUMPS — SKIDMORE CORPORATION ST. JOSEPH, MICHIGAN

"REPAIR THE CEILING AND PUT IN DEZURIK VALVES"



NOW IT'S A NECESSITY

To repair or even replace the damaged ceiling caused by "hidden" valve leakage. On so many air-conditioning or water lines, valve stem leakage causes serious structural damage before the leakage is detected.

PLAY IT SAFE

Eliminate leakage with DeZurik Eccentric-Action Valves. *There's no stem leakage* and no *seat leakage*. None!

ELIMINATE WORRY, CUT COST

With DeZurik Valves installed, you're safe from costly building damage and you're safe from the costs of valve maintenance.

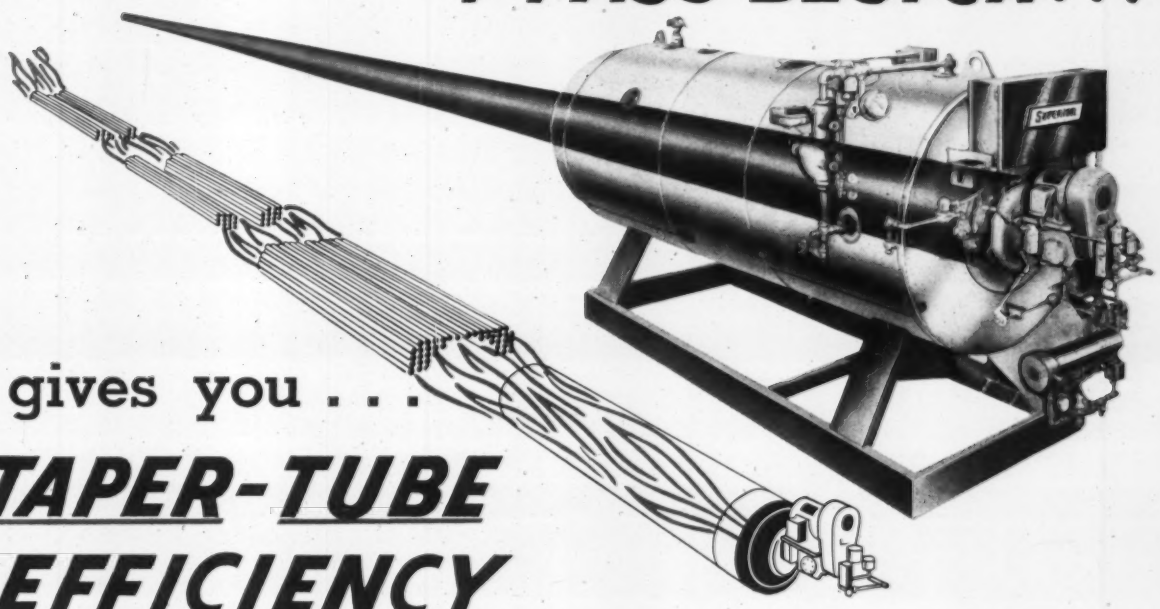
AND REMEMBER

DeZurik Valves mean the easiest operation every time — without lubrication — without binding or seizing — and with longest leak-free life!

See the DeZurik representative in your area, or write to . . . . . .

DeZURIK CORPORATION
SARTELL, MINNESOTA

HOW SUPERIOR'S 4-PASS DESIGN...



gives you . . .

TAPER-TUBE EFFICIENCY

The long-lived efficiency of Superior Packaged Boilers results from fundamentals of design which are basically sound. Superior's 4-pass, down-draft design provides a minimum of 5 sq. ft. of heating surface for each unit of horsepower rating; **and every inch of that heating surface is effective.**

Why 4-PASS?

Theoretically (from the standpoint of heat transfer alone) the fire passes of a perfectly designed fire tube boiler would resemble a long, very gradually tapered cone surrounded by water. The large end would be sized in ratio to the volume and speed of the combustion gases so that the gases would be crowded into the tube and thus "scrub" the walls of the tube, forcing contact between fire and tube surface. As the gases give up their heat to the surrounding water (by transfer through the tube) the gases shrink in volume. The gradual taper of the tube compensates for this shrinkage, maintaining the scrubbing action which promotes efficient heat transfer.

Such a fire tube is impractical; but Superior's 4-pass design achieves the same effect. Its 4 passes are so designed that each successive pass has a lesser number of tubes (and hence a smaller area in cross section) for the passage of combustion gases. This is, in effect, **taper-tube** performance which results in the maximum practical efficiency of heat transfer . . . performance which makes it possible for Superior to guarantee **more** than 80% thermal efficiency **under field operating conditions.**

Superior Packaged Boilers are completely factory assembled, backed by undivided responsibility. Burn gas or oil, or both. Sizes from 20 to 600 b.h.p. for pressures up 250 p.s.i. or for hot water.

For condensed data describing the World's Most Complete Line of Packaged Boilers write today for Catalog S-11

Fire-Tube and Water-Tube PACKAGED BOILERS

for STEAM or HOT WATER

SUPERIOR COMBUSTION INDUSTRIES INC.

TIMES TOWER, TIMES SQUARE, NEW YORK 36, N. Y.

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PACKAGED BOILERS
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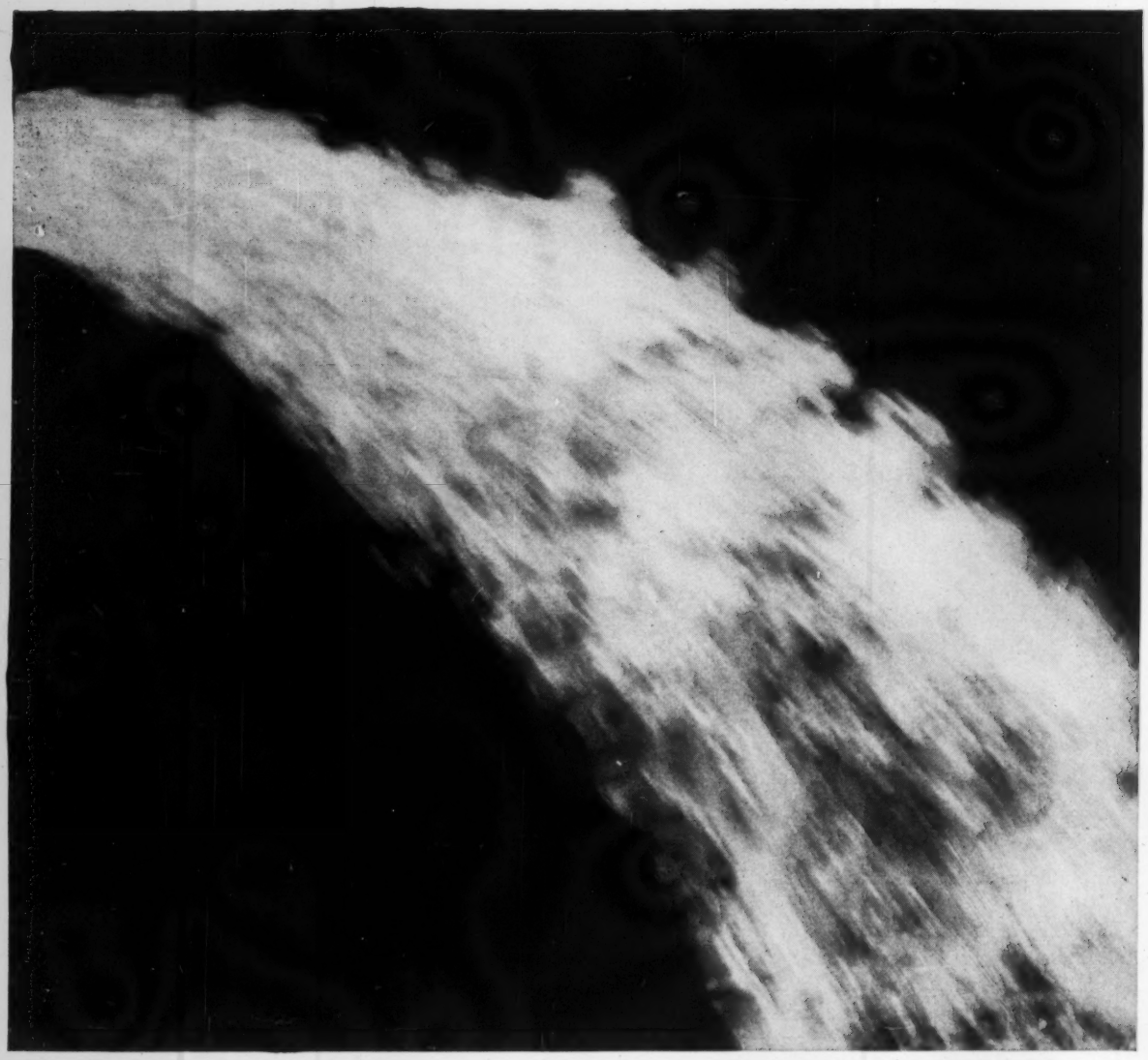


Keep pressure high, pumping costs low with Transite Industrial Water Pipe

Engineered to combine initial-cost savings with long-term benefits, Transite® Industrial Water Pipe has proved to be the economical way to high-quality water-carrying service. It is the choice of economy-minded plant engineers for water supply and distribution lines, process, fire and potable water lines.

Transite's smooth inner walls, with their extremely low coefficient of friction (C=140), offer minimum resistance to water flow. These walls *stay* smooth too because this non-metallic pipe resists internal corrosion. Transite resists outside corrosion as well. Its strength provides a service life that pays for itself in reduced operation and maintenance expenses. Finally, Transite's permanently-tight Ring-Tite® Coupling prevents water-wasting leaks. Water pressure remains high, pumping cost low.

Learn how easy-to-install Transite Pipe can provide the solution to your industrial water problems. Write Johns-Manville, Box 362, HP-10, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable address: Johnmanvil.

JOHNS-MANVILLE JM

For complete plant heating you need both...

WING

STEAM, HOT WATER OR HIGH TEMPERATURE HOT WATER*

REVOLVING and DOOR HEATERS

Wing Revolving Discharge Heaters give you:

Uniform heating . . . Warm air is distributed widely and evenly in a gentle flow—no hot blasts or cold areas — heat moves over and around obstacles.

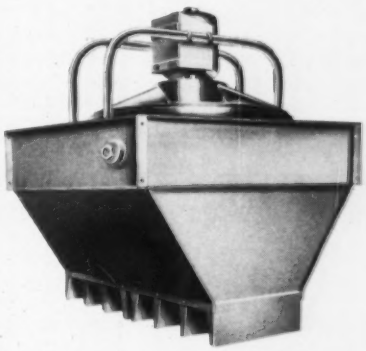
Big area coverage . . . Perfect heating coverage from mounting heights as low as 8′ and high as 65′—areas up to 144′ x 144′ can be covered by a single heater.

No heat stratification . . . All the heat paid for is used — truss area heat is recirculated to the working level — low temperature differentials are maintained.

Low installation cost . . . Fewer Wing Revolving Heaters are required to supply most plant heating needs — you save on wiring, piping and installation labor costs.

Simplified maintenance . . . Tubes are mechanically connected to headers. Individual tubes can be removed or replaced on the job — unnecessary to replace entire heater section.

WRITE FOR BULLETIN HR-6A



Wing Door Heaters give you:

Improved worker comfort and efficiency . . . Large shipping doors are blanketed with high velocity streams of warm air whenever they are opened in cold weather. Incoming cold air is effectively tempered. Nearby workers remain comfortable. Production stays normal. Draft caused illnesses are minimized.

Stabilized plant temperatures . . . The spreading of cold air through large plant areas is avoided even where negative pressures caused by exhaust systems prevail.

Low operating costs . . . Uses steam only when doors are open.

Wide range of sizes . . . Ten sizes are available to suit rolling, overhead or other types of industrial doors. The largest provides protection against outside temperatures as low as −20° F.

Wing Door Heaters can be supplied with Vari-Jet discharge. Automatically converts to perimeter or space heater when doors close.

WRITE FOR BULLETIN DH-2B

**Gas-fired models also are available*

WC-165

WING

L. J. WING MFG. CO.
DIVISION OF AERO-FLOW DYNAMICS, INC.
LINDEN, NEW JERSEY
FACTORIES: LINDEN, N. J. AND MONTREAL, CANADA
IN EUROPE: WANSON, HAREN-NORD, BRUSSELS, BELGIUM

How to gain effective insulation

Insulate and Protect Hot or Cold Underground Piping in One Operation

By GENE HOPPE,
Product Manager,
Witco Chemical Company, Inc.
Pioneer Products Division

Are you troubled by the problems involved in installing permanent underground hot and cold piping?—by the complexity of operations required to insulate, protect against corrosion and electrolysis and ward off water infiltration?—or by cracked concrete allowing exposure to ground chemicals and moisture? Here is your answer to effective insulation and protection. Now a material has been created that handles all these problems at one stroke—WITCOLITE®

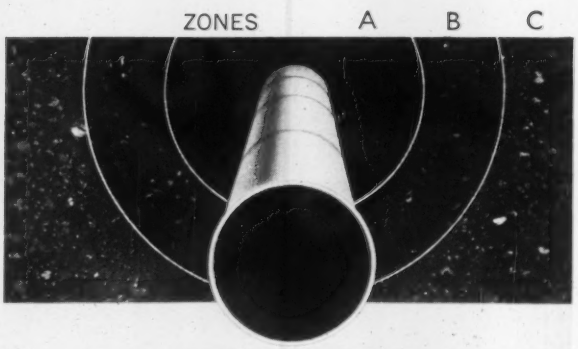
What is WITCOLITE?

WITCOLITE is a dry, granular, adhesive material, manufactured under carefully controlled conditions from resinous hydrocarbons of petroleum origin. It forms a permanent and flexible, highly effective insulating and corrosion-resisting structure around pipes when they are originally heated to recommended temperatures.

Estimated Wt of WITCOLITE

Pipe Size Inches	No. of 50-lb bags for 10 lineal ft
1 - 2	5
3 - 4	8
5 - 6	15
8	20
10	34
12	40
14	51
16	65
18	73
20	92

WITCOLITE is delivered to the job site in 50-lb bags. It is poured into a trench or form surrounding the pipe and tamped down with conventional equipment. Backfilling can be started after heat cure is completed.



How Does it Work?

As WITCOLITE is subjected to heat of piping, a 3-zone structure is formed: (A) Cured Zone—consisting of an insulating and anticorrosive area locked around pipe; (B) Sintered Zone—an air-pocketed insulating and moisture-resistant barrier; (C) Granular Zone—loose particles providing maximum thermal insulation.

Where is it Used?

WITCOLITE is used wherever hot underground piping is installed: industrial plants, refineries, public utilities, schools, institutions, municipal buildings and others. It can also be used with pipelines that alternately convey hot and cold liquids.

WITCOLITE TECHNICAL DATA

Thermal Insulation Value (K)	0.40 to 0.60 BTU per hr, per sq ft, per degree F, per inch of thickness Zone A 1.0 Zone B 0.40 Zone C 0.60	Flash Point 550°F Bulk Density 40 lbs per cu ft (Granulated) 1¼ cu ft per 50-lb bag; 50 cu ft per ton (Compressed) 45.0 lbs per cubic foot
Fusing Point	Grade A: 212° or less Grade B-1:212 to 300°F Grade B-2:300 to 360°F	Adhesion to Metal Lbs per sq in @ 77°F (Scott Tensilometer) Grade A: 255 Grade B: 275
Compression Strength Fused Zone @ 70°F (Soiltest compression tester)	Grade A: 1400 psi Grade B: 1460 psi	Steam Pressure (Gauge) 120 psi Approx Temperature Zone A 165°F Zone B 130°F Zone C 110°F
Water Absorption Total Immersion 6 wks @ 77°F	Grade A: 0.732% gain Grade B: 0.701% gain	

Complete information on properties and applications of WITCOLITE is given together with installation instructions in our Technical Service Bulletin W-22. Write today for your copy to Technical Service Dept 8105

WITCO CHEMICAL COMPANY, INC., PIONEER PRODUCTS DIVISION, 122 East 42nd St., New York 17, N.Y.

SALES OFFICES: NEW YORK • CHICAGO • LOS ANGELES • TORONTO AND MONTREAL, CANADA

PIONEER division of WITCO

EQUIPMENT DEVELOPMENTS

Copper Fittings Are Precleaned, Prefluxed, and Protective Coated

Cast bronze and wrought copper "Color-Guard" fittings are chemically cleaned of oxidizing elements, protected with a micro-thin coating of tin, and prefluxed. Tin coating promotes capillary action to improve the solder flow; also increases tensile strength of cast fitting joints. Can be stored indefinitely under normal conditions without additional cleaning or fluxing. Send for additional information. — *Nibco, Inc., Elkhart, Ind.*

Forced Air Space Heater Has 3 Million Btuh Output

Heats large open areas in factories, shops, and warehouses. Generates a maximum air flow of 38,000 cfm. Available with four types of burners, gas, light or heavy oil, and combination gas and light oil. May be installed upright on the floor or raised above the floor level. May also be suspended horizontally or inverted. Flame and combustion gases flow internally four times across the path of the air to be heated. Send for bulletin No. 580-12D. — *Dravo Corp., Neville Island, Pittsburgh 25, Pa.*

Extruded Aluminum Air Diffusers Feature "Staccato" Louvers

Diffusers' louvers have been recessed at regular intervals with the intervals being varied to create a "staccato" effect. A series of short-spaced "dashes" along each louver stands out in relief against a dark background. Face of raised sections are in brushed satin aluminum finish. Can be used in sidewall or ceiling. Available in two basic types in a variety of patterns. Send for catalog SLD-61. — *Titus Mfg. Corp., P.O. Box 810, Hiway 20 West, Waterloo, Ia.*

Fittings and Flanges For Thermoplastic Pipe

Injection-molded fittings and flanges for firm's "Geon" unplasticized polyvinyl dichloride pipe. Withstand temperatures to 215 F. Schedule 40 and 80 fittings and flanges available in ½ through 2 in. pipe sizes. Schedule 40 pipe safely handles 125 psi pressure at 185 F. Pipe and fittings are joined with solvent, threaded, or cemented joints. — *Tube Turns Plastics, Inc., Louisville 11, Ky.*

Packaged Coal-Fired Boiler Rated to 300 Hp

Develops up to 10,000 lb of steam per hr. Combines boiler, stoker, combustion control system, coal conveyor, and ash conveyor. Can be operated at 10 to 100 percent of capacity. Any number of units can be operated in tandem. Six sizes available from 70 to 300 hp. Send for bulletin 161. — *Canton Stoker Corp., 300 Andrew Place S.W., Canton 1, Ohio.*

INFORMATION on capacities, dimensions, applications, and special features in each item is presented in accordance with material furnished by the manufacturers, who may be contacted directly for more details.

Other Departments . . .

Recent Trade Literature 220

We Hear That 232

Meetings and Conventions 239

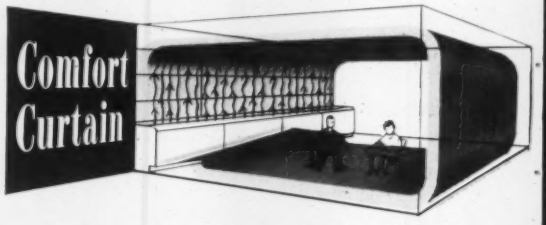
New Books and Reports 244

Don't let YOUR classroom plans include hot spots and cold drafts!

Here is 12-point proof of uniform temperature!
Full perimeter air distribution assures room-wide circulation

Twelve thermocouples (laboratory devices for measuring temperature) scattered throughout the occupied area of this classroom show a reading of 74° at the recorder in the foreground. This is further proof that the Lennox COMFORT CURTAIN® system provides the complete air circulation necessary to maintain a uniform temperature throughout the entire room. Only COMFORT CURTAIN provides a "curtain" of rising air over the entire outer wall and windows . . . at uniform velocity. It sets *all* of the air in the room into gentle motion to eliminate hot spots, cold spots, drafts and stale air. Individual "Day-Nite" thermostats maintain room-wide temperatures within ½° of setting. "No-occupancy" settings permit substantial fuel savings. Because each classroom has its own self-contained system, future building expansion is simplified. For complete information about the COMFORT CURTAIN system and its use with all types of heat sources, write LENNOX, 543 S. 12th Ave., Marshalltown, Iowa. If more convenient, call your nearest Lennox office and ask for a technical representative to call.

LENNOX®



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...Only

LENNOX

Comfort Curtain® provides full room air distribution

WITH...
Individual room control of fresh air ventilating and heating ... for only $1.07 per sq. ft.

Wellerwood Elementary School
Grand Rapids, Michigan
Colton-Hornbach Associates, Architect

Since COMFORT CURTAIN equipment is independently controlled, each room's temperature level can be immediately altered to meet the requirements established by the number of students, their activity, and outside weather conditions. The total heating and ventilating cost for ten classrooms was $1.07 per sq. ft. The COMFORT CURTAIN equipment included: all controls; gas-fired heat sources (in approved heater rooms between every two classrooms); air processing units in each room which control, blend and filter precise amounts of fresh outdoor air, heated air and return air, and *distribute it uniformly along the full length of the exterior wall.* The air is discharged through functional prefinished bookshelf ducts. No central heat plant, furnace room, and elaborate duct or piping systems were required. Simple structural requirements and ease of installation reduced initial costs and over-all expenditures.

EQUIPMENT DEVELOPMENTS

Continued

Fixture Provides Air and Light

Combination air diffuser and light provides air for ventilation, heating, and cooling. "Ventro-lux" with Anemostat air diffuser directs warm or cool air horizontally along ceiling for even distribution. Entire unit assures a low silhouette, 6 in. or less. The two elements in the fixture can be installed separately, eliminating conflicts in trades. Send for literature. — *Curtis AllBrite Lighting, Inc., 6135 W. 65th St., Chicago 38, Ill.*

Steam Coils Feature Even Distribution of Steam Across Coil Face

Steam from both ends of the coil runs through "Equa-Jet" inner distributing tubes. Tubes are automatically self-centering in the condensing tubes and have their jet orifices facing in the same direction as the steam return. Condensing tubes are pitched toward return connection. Available in standard heights and feature die-formed plate-type aluminum fins in standard lengths from 72 to 144 in.; headers at both ends of coil made of heavy-wall seamless copper with heavy die-formed end caps. — *Bohn Aluminum & Brass Corp., Danville Div., Danville, Ill.*

Control Valves for Cryogenic Service

Throttling globe type control valve features tight closing (O leakage) through cool down, on-stream runs, and defrost periods. Design permits complete disassembly of the valve from the top end. Available in ½ to 4 in. bronze, aluminum, or ½ to 2 in. stainless steel bodies with trim materials bonnet length and actuator construction to suit most cryogenic applications. Send for additional data. — *Leslie Co., 105 Delafield Ave., Lyndhurst, N.J.*

Portable Heater Has 13 Hr Firing Capacity

Low pressure firing enables a 0.9 gph consumption of fuel, permitting the heater to operate 13 hr continuously at low fire. Capacity ranges from 70,000 to 125,000 Btu per hr. Weighs 42 lb without fuel. Dimensions are 30¾ by 13 by 26½ in. Can be operated anywhere standard electric voltage exists. — *Thor Power Tool Co., Aurora, Ill.*

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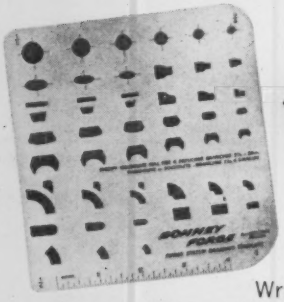
COMPLETE

Write today for the
NEW 1961 BONNEY FORGE WELDING FITTING CATALOG
Weldolets® • Thredolets® • Sockolets® • Elbolets® • Brazolets® Sweepolets® . . . in carbon steel, stainless and alloy for all piping services.



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Write today for this ingenious **FREE**
PIPING SYSTEM WELDING FITTING DRAWING TEMPLATE
You'll find it a useful and constant aid. Yours at no cost from Bonney Forge.

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BONNEY'S NEW FORGED STEEL FITTING CATALOG
No. FSF2-1961. The cleanest, best looking, highest quality Forged Steel Fitting line on the market today.

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Yours with the compliments of . . .

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ALLENTOWN, PENNSYLVANIA

EQUIPMENT DEVELOPMENTS
Continued

Air Handling Units Available With Sectional Construction

Type "D" units available in 12 sizes, with air handling capacities of 600 to 56,000 cfm (600 to 72,000 cfm heating and ventilating only) matched with proper size cooling and heating coils of all types and capacities. Complete range of air filters available: unit, automatic, renewable media, electrostatic, and combination dry electrostatic with automatic renewable media. Send for bulletin No. D-100. — *American Air Filter Co., Inc., Dept. PD,* 215 *Central Ave., Louisville* 8, *Ky.*

Airfoil Fans Made in 7 Sizes, 8¾ to 18¼ In. Diameters

Available with both single and double inlets. Sizes 12¼ to 18¼ in. carry AMCA Certified Ratings Seal. Air volumes range up to 15,000 cfm with temperatures up to 200 F. Send for bulletin ASQ-102. — *Chicago Blower Corp.,* 9800 *Pacific Ave., Franklin Park, Ill.*

Air Washer, Evaporative Cooler Made of Rigid PVC

Cleans, humidifies, and cools incoming air. Will not rust, rot, corrode, or support combustion. All parts made of rigid polyvinyl chloride except 10 gage steel base and stainless steel exterior framework. Metal base is protected by PVC paint outside and a rigid PVC lining inside. Available in three basic models. Has a cleaning efficiency up to 98 percent of all airborne contaminants. Cooling efficiency is up to 95 percent of initial wet bulb depression. Send for descriptive literature. — *S & C Mfg. Co.,* 3533 *Cardiff Ave., Cincinnati* 9, *Ohio.*

HERE'S HOW TO QUENCH THE THIRST OF A MODERN 22 STORY GIANT

Downstairs, upstairs and all around the house Peerless Pumps move up to 15,000 gallons of water every minute for the 55 Public Square Building in Cleveland.

Engineering a modern building for maximum human efficiency calls for water, plenty of water. Water for the air conditioning system, water for sanitation and human consumption. Water for a hundred and one other needs that a huge building like the 55 Public Square structure in Cleveland demands on a round the clock basis.

In the 55 Public Square building the assignment of handling this water has been given over entirely to Peerless pumps. Good reasons, too. First, in the Peerless line the contractor found a complete selection of models to handle his every requirement. During initial startup, when minor adjustments were required, Peerless field representatives were on hand immediately to handle the service requirements. Since that time, the Peerless pumps have operated on a continuous basis with no downtime, moving water all through the building with maximum performance.

Investigate the Peerless lineup of quality pumps for your next building. Large or small, you'll find that Peerless quality and service are unmatched. Write us today for our catalog and the name of your nearest Peerless representative.

Upper left: These Type A pumps are handling condenser water with a 130′ head.

Upper right: Peerless Type DL pumps circulate ethylene glycol to melt snow on walks surrounding the building.

Lower left: Type TU booster pumps handle house water with a 300′ head.

Lower middle: These vertical Hydro-Line® models are handling hot condensate.

Lower right: This series of Type A pumps are in chill water service.

Putting Ideas to Work

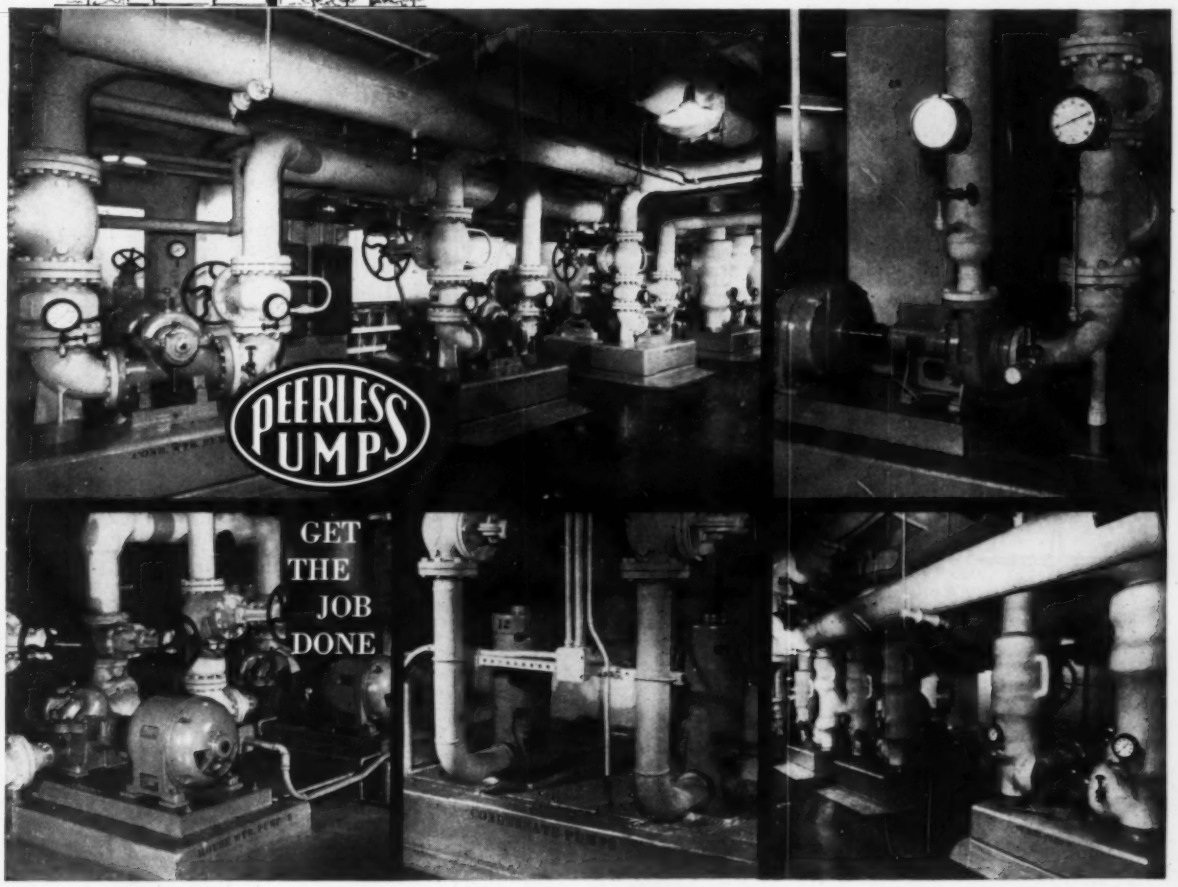
PEERLESS PUMP

HYDRODYNAMICS DIVISION

Plants: Los Angeles 31 California, and Indianapolis 8, Indiana.

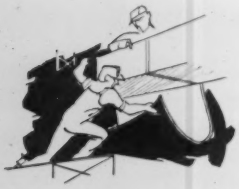
Offices: New York; Detroit; Chicago; Cleveland; Indianapolis; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno.

Distributors in principal cities. Consult your telephone directory.



DUCT WORK
is duck soup
with Silvercote wrap and liner

You'll save time, tempers and money when you use time-tested Silvercote fiber glass duct insulations with their exclusive facings and coatings.



DUCT WRAP Here is the real labor saver! Silvercote offers a wide range of special, reflective and non-reflective vapor barrier facings—their exclusive, low-cost facing adds over 30% to the insulation value of one inch material! For the ultimate in ease of application and insulation value, specify job-proven Silvercote insulations.

DUCT LINER The uniformity and sturdiness of Silvercote liners really pay you dividends! This high-grade fiber glass product, with its many coatings, assures you top performance and customer satisfaction. You'll find it easier to use and it's longer lasting. Ask about the special Silver Vinyl coating and FR (flame resistant) Duct Liner.

Write today for this informative literature and the name of the Silvercote distributor nearest you.

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EQUIPMENT DEVELOPMENTS

Continued

Cast Iron Boilers Rated Up to 5,760,000 Btuh Input

Gas-fired boilers for low pressure steam or hot water applications. Available in 29 capacities ranging from a five-section 720,000 Btu per hr input to a 33-section 5,760,000 Btu per hr input model. Boilers are rated at 180,000 Btu per hr per flueway. Feature stainless steel ribbon ports, wide choice of operating control sets, six sizes of tankless heaters with capacities from 3½ to 15 gpm, and three sizes of storage heaters. Can be ordered for left, right, or both left and right placement of various controls and tankless heaters. — *Mueller Climatrol, Div. of Worthington Corp., 2005 W. Oklahoma Ave., Milwaukee 1, Wis.*

Registers Available For Commercial Applications

Feature individually-pivoted vertical face bars and a horizontal multilouver valve. For use in applications where an opposed-action valve is not required. Finished in beige baked enamel. Send for bulletin 304-AC. — *Air Control Products, Inc., Coopersville, Mich.*

Silencer Controls Noise in High Pressure Air Systems

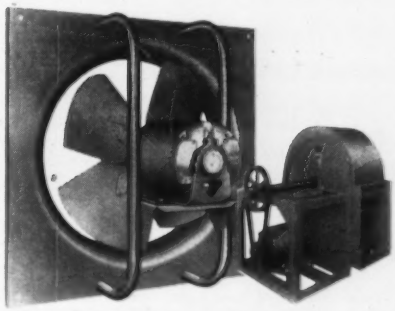
Features a bell-mouth entrance for minimum entrance loss and a solid nose entrance for maximum noise reflection. A narrow throat passage provides for maximum impedance. A straight throat passage provides for minimum air friction. Available in two types, standard and low pressure, and in many sizes to meet all performance requirements for air conditioning and ventilating systems.— *Industrial Acoustics Co., Inc., 341 Jackson Ave., New York 54, N. Y.*

Talk About Fans!

Okay, let's talk about fans . . . Peerless Electric Fans in particular. Breeze or hurricane . . . you name it, and there's a Peerless Electric Fan to produce it. All-welded construction keeps scroll, housing and inlet firm and quiet. Air passes through at peak efficiency. All-welded wheels are statically and dynamically balanced for perfect rotation. Peerless Electric Fans can be specified with confidence, installed with ease, and operate inconspicuously and dependably for years.

Investigate Peerless Air Moving Equipment Today! Write to Peerless Electric Division, H. K. Porter Company, Inc., 1409 West Market St., Warren, Ohio.

Manufactured and sold in the western states by Master Fan Corporation, H. K. Porter Company, Inc., 1323 Channing Street, Los Angeles 21, California. NOW AVAILABLE—Centrifugal Blowers to 132" wheel diameter, Turbo Blowers to 55" S. P., Tube and Vaneaxial Blowers and Industrial Fans to 104" wheel diameter.



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New
HEAVY DUTY
PIPE
WRENCHES
with the "work" and "feel" you expect from REED pipe tools!
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REED MFG. CO. ERIE, PA. U.S.A.
THESE NEW HEAVY DUTY WRENCHES ARE DESIGNED TO REED STANDARDS OF TOUGHNESS, LONG SERVICE, AND SMOOTH, EASY USE.
Pearlitic malleable handle and housing are designed with heavy sections at the stress points, without sacrificing lightness and "feel."
•
Calibrated hook jaws are drop forged, milled and triple heat treated for toughness and long wear.
•
The patented double-spring action lets you grip and ratchet faster and with less lost motion.
•
Regular models in all lengths from 6" to 48". Offset design (for hard-to-reach corners) in 8", 10", 14" and 18".
•
Both designs meet or exceed Federal Specifications GGG—651c, Type 11, Class A.
See these new Reed Wrenches at your Jobber.
BUY them to save time, money and trouble.
REED MANUFACTURING COMPANY
Erie, Pennsylvania

EQUIPMENT DEVELOPMENTS

Continued

Centrifugal Pump Has 1000 Gpm Capacity

Features sleeve bearing forced feed lubrication and a "self aligning" coupling that connects 1750 rpm sleeve bearing motor to pump, eliminating necessity of on-job realignment. Fabricated angle iron base permits quiet operation and easy cleaning access in and around pump. Produces heads to 80 ft. 11 models available, 1 through 10 hp. Send for form 1445. — *Dunham-Bush, Inc., West Hartford, Conn.*

Heater Assemblies Have Capacities to 1,400,000 Btuh

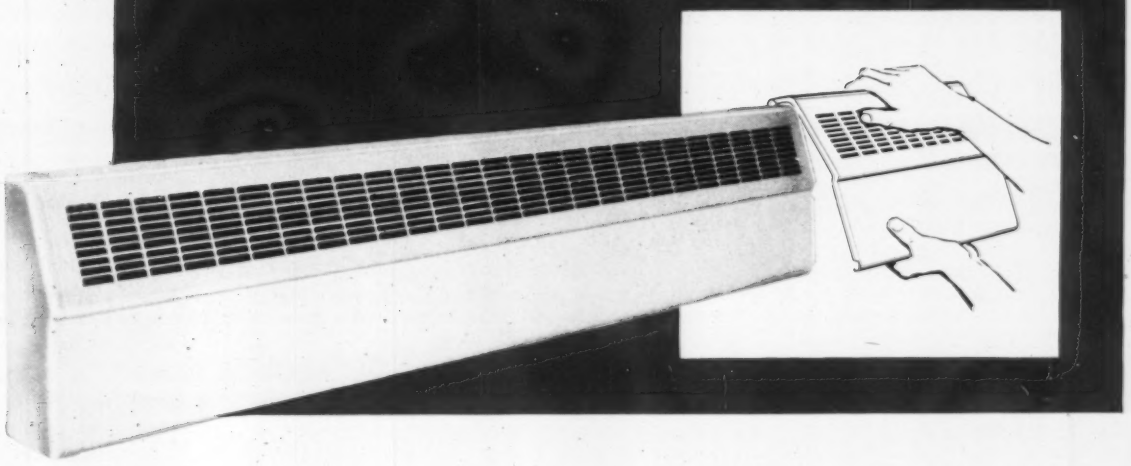
Assemblies consist of from one to four duct furnaces together with complementary packaged blowers, mechanical flue exhauster, and control system. Four models available in capacities from 200,000 to 1,400,000 Btu per hr input. Assembled in either push-through or pull-through arrangements. All components are rigidly bolted to heavy angle iron bases, forming a single installation. Send for additional information. — *Reznor Mfg. Co., Mercer, Pa.*

Oil-Fired Cast Iron Boilers Rated to 1,422,000 Btuh Output

Available in 14 sizes, ranging from I-B-R gross output ratings of 386,000 to 1,422,000 Btu per hr; net ratings of 1205 to 4500 sq ft of steam and from 289,600 to 1,079,700 Btu per hr. Also suitable for stoker firing with anthracite coal. Vertical flue travel combined with hundreds of heat absorbing pins on the surfaces of the boiler sections permit low stack temperatures and minimum draft loss. — *Thatcher Furnace Co., Dept. 15P, Garwood, N. J.*

WALVECTOR WINS INDUSTRY ACCEPTANCE DOWN THE LINE

WHY? ONLY WEBSTER WALVECTOR FEATURES TRU-LOCK JOINT



ASK THE ARCHITECT: Here's a genuinely handsome enclosure—with all edges rolled—in a complete line of fin tube radiation. No butt trims or exposed screws break the clean functionally styled lines of a Webster Walvector installation. Enclosure profile is now the narrowest in the industry.

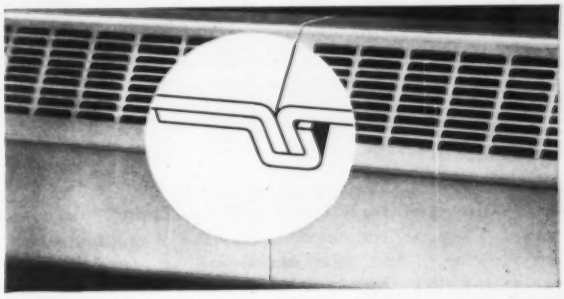
Only Webster Walvector has Tru-Lock Joint design.

ASK THE ENGINEER: Tru-Lock Joint assures trim enclosure appearance—with a degree of structural strength and rigidity not otherwise possible. Rugged interlock channel welded to the right end of each enclosure interlocks with the rolled *left* edge of the next. Rolled edge construction *plus* interlock channel provide vertical stiffeners at every joint!

Behind the enclosure? Additional design and construction features to ensure a long-lasting installation . . . and Webster Tru-Perimeter fin tube radiation — industry standard for steam or hot water heating comfort and system efficiency.

Only Webster Walvector has Tru-Lock Joint design *and* Tru-Perimeter radiation.

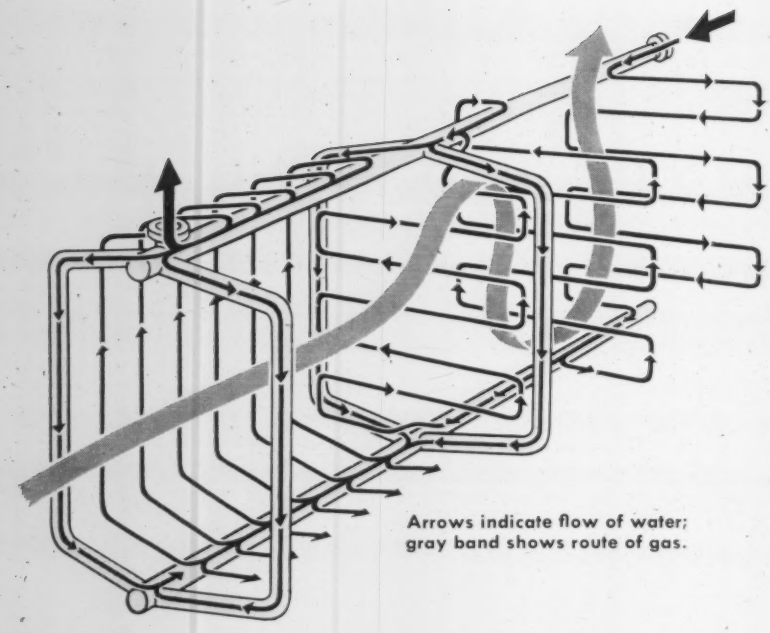
ASK THE CONTRACTOR: New Webster Walvector with Tru-Lock Joint permits *easiest* one-man installation. Elimination of butt trims and fastening screws eliminates time and labor, too. Special packaging saves installation time, too; all "roughing in" materials are shipped in advance if desired . . . enclosures as required to meet installation work schedules. New Webster Walvector is designed *and* packaged with the contractor in mind.



ASK YOURSELF: Why not know more about the advanced features now available with new Webster Walvector? Your nearby Warren Webster representative will be pleased to tell you.

WARREN WEBSTER & COMPANY, INC.

HEATING • COOLING / CAMDEN 5, NEW JERSEY



Why BROS High Temperature Water Generators Offer You Efficiencies Never Before Available!

If you are interested in truly *efficient* space heating or in chemical processing which demands *precise control of temperatures*, it will pay you to investigate the BROS High Temperature Water Generator.

Water vs. steam. High temperature (300° to 450°) water offers you important advantages for heating. Depending on pressures and temperatures, water will store approximately 20 times as much heat as an equal volume of steam. The BROS HTW Generator shown above is especially economical for horizontal movement of large amounts of heat.

Factory-assembled. BROS HTW Generators are completely packaged units. They are efficient, reliable, easy-to-clean, and inexpensive-to-maintain.

The unusual efficiency is due to several features: counterflow of gas and water . . . all heating surfaces consist of tubes (no extended surfaces) . . . deep furnace design which provides long flame travel . . . super-effective insulation.

Combines gravity and forced circulation. Circulation with a BROS HTW Generator does not require orifices at entrance or exit of tube circuits in order to regulate and proportion the water flow. Instead, gravity circulation is used to augment forced circulation. This automatically provides uniform flow throughout radiant tube circuits and virtually eliminates possibility of damage due to pump or line failure.

No thermal shock. Even when return water is reintroduced at temperatures 200° lower than when it leaves, there's no risk of damage from thermal shock.

Capacities, pressures. These compact generators are available for temperatures between 300° and 450°F with corresponding saturated pressures from 70 to 425 psig. Capacities range from 2 million to 70 million btu per hour.

For illustrations, features, drawings, specifications and complete performance data, see your nearest BROS Representative . . . or write

POWER DIVISION

BROS *Incorporated*

1057 Tenth Avenue S. E., Minneapolis 14, Minnesota

EQUIPMENT DEVELOPMENTS

Continued

Gas-Fired Unit Heater Features Centrifugal Blower

Recommended for applications requiring quiet operation. Available in eight basic sizes with heating capacities from 50,000 to 250,000 Btu per hr input. AGA approved for use with natural, manufactured, mixed, and LP gases, including LP gas-air mixtures. Suited for installation with or without ductwork. Can be automatically controlled by a room thermostat. Driven by a constant speed motor through a variable speed V-belt drive. Equipped with such automatic safety devices as high limit switch, gas valve, constant burning pilot, pilot switch, and gas pressure regulator. Also has a blower delay switch to aid in warm-up. — *American-Standard Industrial Div., Detroit 32, Mich.*

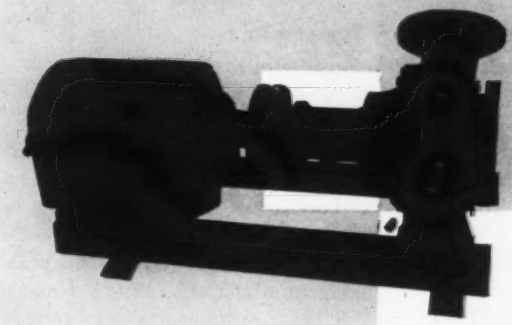
Power Gas Burners Have Capacities to 800,000 Btuh

Units available in a capacity range of 75,000 to 800,000 Btu per hr. The 800,000 Btu per hr model has a 5 in. diameter tube. Available with either thermo-electric or electronic controls. — *Mid-Continent Metal Products Co., 2717 North Greenview Ave., Chicago 14, Ill.*

Industrial Dehumidifier Removes Up to 75 Lb of Water Per Hr

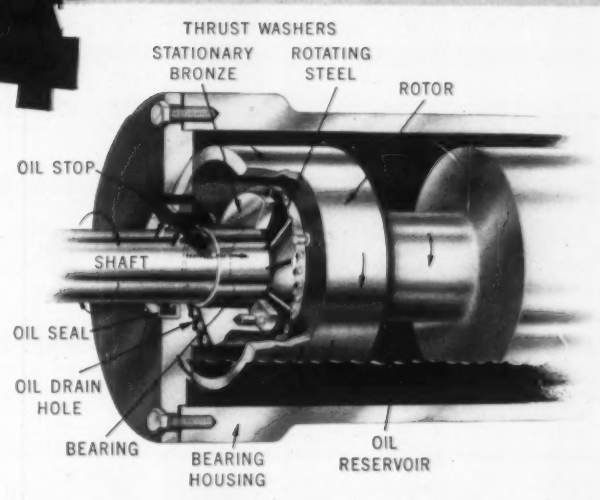
Packaged adsorption dehumidifier handles 3000 cfm of air. Choice of electrical, steam, or gas reactivation systems. Features "plug-in" installation and easy accessibility to filters and motors. Send for additional information. — *Universal Dynamics Corp., 4200 Wheeler Ave., Alexandria, Va.*

NEW DUNHAM-BUSH B9 CENTRIFUGAL PUMP WRITES ITS OWN SPECS



"With sleeve bearing forced feed lubrication...

Rotor picks up oil from sump . . . forces up to oil stop and flows back to lubricate sleeve bearings and shaft . . . passes through fingers, lubricating thrust washers and returns to sump . . . process is continuous.



and self aligning flexible coupling"

People who know pumps will readily recognize the superior lubrication and coupling advantages of the new Dunham-Bush B9 centrifugal pump. Exclusive and unique sleeve bearing forced feed lubrication extends bearing life far beyond normally expected operation. A "self aligning" coupling that connects sleeve bearing motor to pump eliminates realignment on the job and provides considerably longer coupling and bearing life. Additionally, the B9 is designed to ensure ultra quiet operation . . . low maintenance . . . superior pump performance.

For facts about this startling new feature packed centrifugal pump, write for Form No. 1445.

- **1750 RPM Sleeve Bearing Motors**
- **Capacity up to 1000 GPM and Heads to 80 feet**
- **11 Models—1 H.P. thru 10 H.P.**
- **Base-Fabricated Angle Iron for noise elimination and easier cleaning in and around pump**
- **Seal-Rated at 250 degrees as standard equipment**
- **Specifically designed for efficient and quiet handling of chilled or hot water in comfort conditioning systems**

Request additional literature describing the complete Dunham-Bush family of Pumps . . . In-Line Circulators and Close Coupled Centrifugal Pumps

DUNHAM-BUSH

DUNHAM-BUSH, INC.

WEST HARTFORD 10, CONNECTICUT, U. S. A.

SALES OFFICES LOCATED IN PRINCIPAL CITIES

EQUIPMENT DEVELOPMENTS

Continued

Liquid Filter Chambers Unit Has 800 to 1200 Gph Capacity

Filters corrosive, radioactive, and other problem fluids. Suitable for temperatures to 140 F when constructed of transparent lucite; other materials available for higher temperatures. All filter chambers are furnished with a threaded stainless steel Type 316 center rod which extends through the base of the chamber to facilitate mounting. Stainless steel parts can be replaced with hastelloy C or plastics when very corrosive liquids are filtered. Send for bulletin 402. — *Sethco Mfg. Corp.*, 2284 *Babylon Turnpike, Merrick, L.I., N.Y.*

Gas Duct Furnaces for Downstream Installation

AGA approved for installations downstream of refrigeration coils. Stainless steel condensate shield diverts moisture formed inside heat exchanger tubes away from the pilot, thermocouple, and ignition slots into an aluminized steel bottom pan with threaded drain connection. Available in seven sizes from 75,000 to 300,000 Btu per hr, and may be close-coupled to any total capacity. Heat exchangers are guaranteed for 10 years. Fan and blower models are available in models up to 300,000 Btu per hr, and industrial furnaces up to 900,000 Btu per hr. — *Hastings Air Control, Inc.*, 3215 *Leavenworth St., Omaha* 5, *Nebr.*

Humidity and Temperature Indicators Are Flush Mounted

Indicators project through the cabinet or room wall to a depth of 1 in. and make measurements of the other side. Hygrometer can be used in temperatures up to 230 F, and measures relative humidity from 0 to 100 percent. Thermometer measures from −30 to 130 F. Both units have 5⅛ in. dials and solid brass casings. — *Abrax Instrument Corp.*, 179-15 *Jamaica Ave., Jamaica* 32, *N.Y.*

Heat Exchangers Offered In Compact Models

Shells available with diameters from 3¼ through 8¼ in. and in lengths from 16¾ in. through 6 ft 7 in. Shells, connections, and bonnets made of ferrous materials. Available in one, two, and four pass models. Send for bulletin F-1161. — *Basco, Inc.*, 345 *Payne Ave., North Tonawanda, N.Y.*

CHECK THESE FEATURES

- ✓ Stops pulsating and chattering
- ✓ Increases heating efficiency and ouptut
- ✓ One unit handles furnace or boiler, incinerator and hot water heater on single chimney
- ✓ Keeps furnaces, boilers and chimneys free of soot
- ✓ Stops blow-back of poisonous fumes
- ✓ Ideal for homes with outside chimneys
- ✓ Fireplace units with special fittings for direct installation into chimneys with single or two-speed motors available

Will operate with temperatures up to 1700 degrees

A COMPLETE LINE OF RESIDENTIAL AND LIGHT CONSTRUCTION MODELS

SIZES AVAILABLE
4 INCH
5 INCH
6 INCH
7 INCH

SIZES AVAILABLE
8 INCH
9 INCH
10 INCH

12 INCH

Patents
U. S. 2,722,872 and 2,856,874
British 802,920
Canadian 588,817
Other patents pending

10175-QD

WRITE FOR NEW LOW PRICES ON ALL THESE MODELS

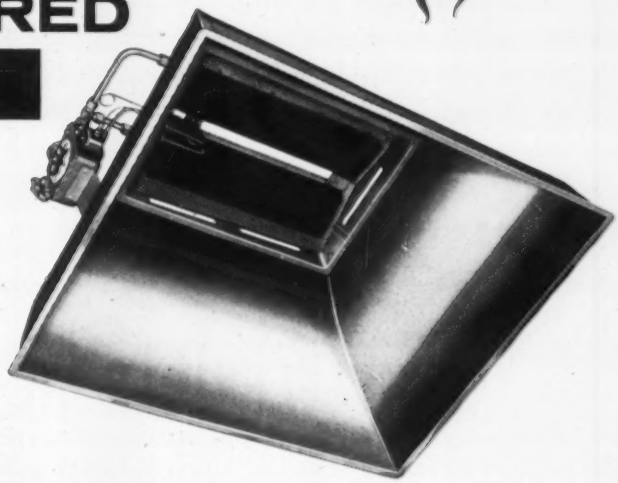
HEAVY-DUTY INDUSTRIAL UNITS AVAILABLE
12" 14" 16" 18" 20" 22" 24" 30"
Larger sizes can be made to order

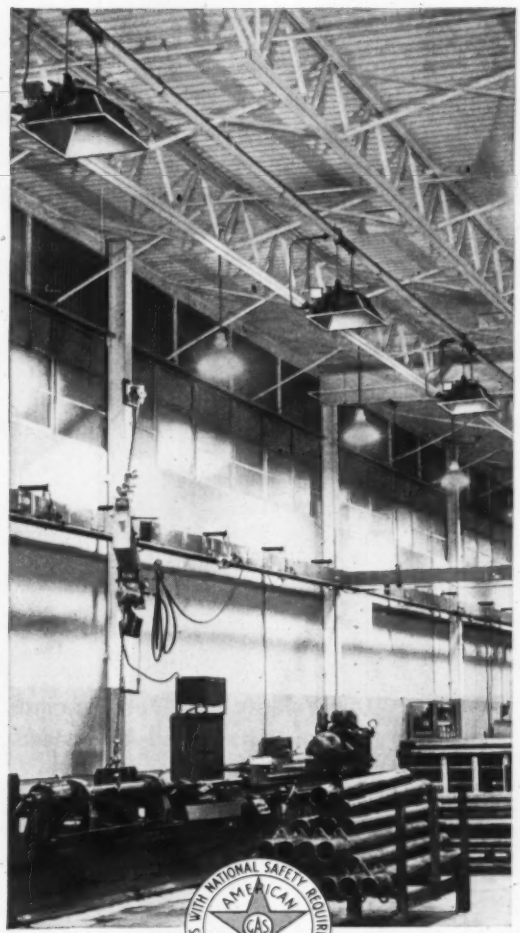
For corrosive service all Quickdraft units are available in standard acid-resisting vitreous enamel, 316 stainless steel, rigid plastics (P.V.C) and with plastic or Fiberglas coatings.

Quickdraft CORPORATION

P. O. Box 1353-K
Sta. C
Canton S.W., Ohio

specify
VAN DORN
GAS FIRED
INFRA-RED
AREA HEATERS





ALL METAL CONSTRUCTION

Van Dorn Infra-Red Gas Fired Heaters and Generators are unique in that they utilize a high nickel alloy grid, Inconel metal. The burner plenum is made of grey cast iron while the grid frame is of high quality stainless steel. Special high temperature gaskets give assurance of long life, trouble-free operation. Since there are no moving parts, maintenance costs are kept to a minimum. Substantial savings in fuel costs have been reported from Van Dorn installations throughout the country due to the high Infra-Red radiation efficiency of the Van Dorn Generator design. All Heaters have A.G.A. Approval and carry U.L. Listing.

COMPUTE YOUR FULL B.T.U. REQUIREMENTS BY MEANS OF THIS VAN DORN HEATING CALCULATION METHOD

Compute square footage of exterior walls. Deduct from this figure total square footage of doors and windows arriving at net wall area. Compute square footage of roof. Compute square footage of floor. Compute cube of building to use as multiplier for Infiltration and Air change figures . . . Use the proper "U" factors and temperature maximum with above to determine total BTU heat loss. Consult engineering handbook for "U" factors.

EXAMPLE: A building 100′ x 200′ x 15′ at eaves and 25′ at center peak. 12" conc. block, conc. floor, metal roof 2" insul., one air change and 0 to 65° F. temp. range.

Walls 200 x 15 x 2 plus 100 x 20 x 2 = 10,000 sq. ft.	
Windows and doors = 1507—Net wall area 8493 x .33 x 65 . .	182,174
Windows 960 x 1.1 x 65	68,640
Doors 547 x .51 x 65	18,133
Roof 52 x 200 x 2 = 20,800 x .13 x 65	175,760
Floor 100 x 200 = 20,000 x .17 x 15 (Max. Temp. less 50) . . .	51,000
***Infiltration** 100 x 200 x 20 = 400,000 x .002 x 65	52,000
Air change 400,000 x .018 x 65	468,000
Total heat loss	1,015,707 BTU

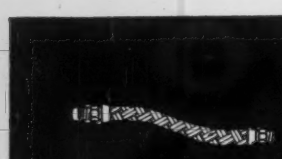
*Note: The figure 20 used in cube of bldg. is avg. ht.

Take 80% of above total or 812,565 and divide by 20,000. This will tell you the number of Van Dorn Single Generator units needed, or 41 in this case. If Double Generator units are to be used, divide by 40,000 and 20 will be required.

Write for Illustrated Brochure

Screen and Plenum—Patents Pending
Casting—Licensee under Schwank Pat. No. 2,870,830

THE VAN DORN IRON WORKS CO. *INFRA-RED DIVISION*
2685 East 79th Street • Cleveland 4, Ohio



FLEXIBLE METAL HOSE & TUBING

HEAT RESISTANCE + PRESSURE RESISTANCE
+ CORROSION RESISTANCE + FLEXIBILITY

- Absorb expansion
- Isolate vibration
- Correct misalignment
- Compensate offset motion
- Continuous flexing
- Reciprocating motion
- Loading hose, and all extreme bending and flexing applications.

ALLIED'S wide range of *IN-STOCK* standard flexible metal hose connectors will solve your pipeline-motion problems *FAST*.

ALLFLEX

"MNH" FLEXIBLE METAL HOSE CONNECTORS

STAINLESS STEEL • BRONZE • MONEL
SAME DAY SHIPMENT on ALL THESE STOCK SIZES:
¼" ⅜" ½" ¾" 1" 1¼" 1½" 2" 2½" 3" 4"
EACH IN ALL THESE STOCK LENGTHS:
12" 18" 24" 30" 36" 48" 60" 6 ft. 8 ft. 10 ft. 12 ft. 15 ft.

"TOMORROW" shipment of *any* length, with *any* end fitting connection. S/S to 16", Bronze to 8", Monel to 4".

ALLFLEX

DIESEL HOSE

- **STAINLESS STEEL**
- **CARBON STEEL**

Tames Vibration and Compensates for expansion on EXHAUST and AIR INTAKE LINES

SIZES: Thru 16" CONFORM TO GOVT. SPEC. MIL-H-19034

ALLFLEX

EXPANSION COMPENSATORS

Absorb pipeline expansion • Installed at right angles to direction of movement • Custom engineered to solve your specific problem • For pipelines thru 16" size • Temperatures to 1200°F.

All Allflex products available with all standard or special couplings and flanged end connections. Write, wire, phone today for your ALLFLEX DATALOG and name and address of your nearest ALLIED FLEXOLOGIST.

Heating, Airconditioning & Piping Division

ALLIED METAL HOSE CO.

3745 Ninth Street, Long Island City 1, N. Y. • N.Y.C. Phone: 212-ST 4-5173

EQUIPMENT DEVELOPMENTS

Continued

Pump Handles Non-Corrosive Liquids to 180 F

Fractional horsepower, single stage, single suction pump handles clear non-corrosive liquids at temperatures up to 180 F. Available in a range through 48 gpm with heads to 100 ft. Cast iron unit has enclosed "Delrin" impellers and screwed connections. Can be installed horizontally or vertically. Casings have center line discharge, are self-venting, and can be rotated to any of four positions 90 deg apart. Rated at 1/3 through 1 hp in both single and 3 phase construction at 3450 rpm. — *Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukeee 1, Wis.*

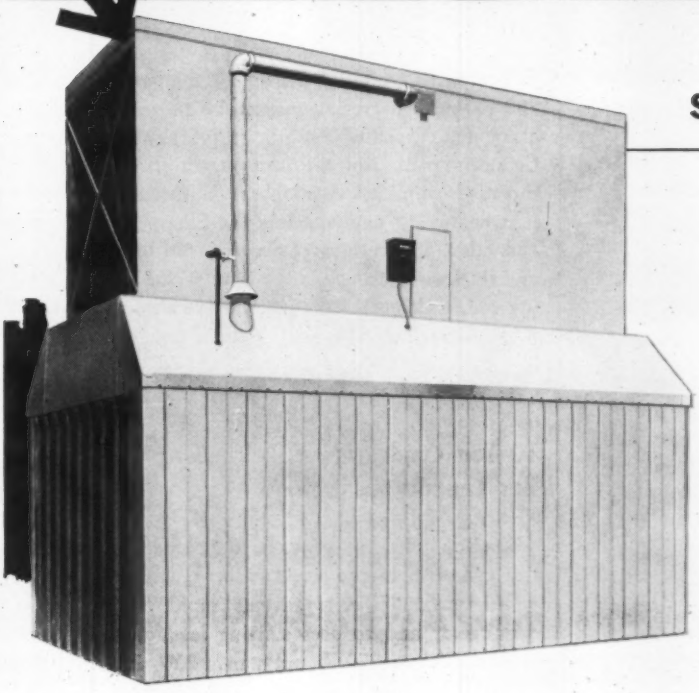
Smoke Detector for Air Conditioning, Heating

Operates a relay to close dampers in air conditioning and other duct systems if smoke is present. Also used as a smoke alarm for heating systems. Can be wired to a remote time-delay cut-off to turn burner off if smoke persists for more than a certain designated time. Device is operated electronically. Send for additional information. — *Fuel Watchman Co., 77-29 138th St., Flushing 67, N. Y.*

Low Velocity Dual Duct Terminal Control Units for All-Air Systems

Units offer individual room temperature control and attenuation of self-generated and duct-carried noise. Manual volume adjustment and choice of operation by either pneumatic or electric temperature controls. Two ceiling models available: bottom and end discharge, in two sizes. Send for Catalog No. 1361. — *Carnes Corp., Verona, Wis.*

Havens PROVES THE PERFECT PACKAGE FOR ANY JOB!



UNIQUE 3 PACKAGE SIDE BUILDING INSTALLATION at the NEW

HOME OWNERS MART

IN KANSAS CITY

133,000 square feet under roof at the New Home Owners Mart in Kansas City, Missouri. This low lengthy roof has no towers or air conditioning units on it. Three 125-ton Havens' towers are installed beside the building. Each Havens' tower forms the roof of a steel structure enclosed with curtain wall which serves as an equipment room containing a 125-ton compressor and related equipment.

Havens Performance Proven Cooling Towers

Havens, the name to remember in packaged cooling towers, offers more versatility for air conditioning, refrigeration and industrial process. The complete line of packaged towers and multiples from 5 thru 600 tons. Be sure to get the tower that fits the structure . . . the HAVENS COOLING TOWER.

Havens COOLING TOWERS
DIVISION OF **HAVENS STRUCTURAL STEEL CO.**
1713 CRYSTAL AVE., KANSAS CITY 26, MISSOURI

No. 331 WG

This new "Fabrikated" design wall grille has 14 gauge (.083) horizontal bars ¾" deep. Vertical bars are 14 gauge by ½" deep. All bars are solid steel with rounded (mill) edges. Construction is exceptionally rigid. Free air is approximately 70%.

Recommended for ceiling, wall, and sill window installations for continuous design effect in schools, hospitals, banks and public buildings where heating, ventilating or air conditioning systems are required.

No. 331 WG design can also be furnished in core style only without rims or borders. Write for Catalog No. 61.

Always Leading—Always Progressing

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET · CLEVELAND, OHIO

EQUIPMENT DEVELOPMENTS

Continued

Float Thermostatic Steam Trap Has Indestructible Bi-Metal Control

Equipped with an indestructible stainless steel bi-metal thermostatic air vent. Shuts tightly on steam to prevent waste. Rocker design, which simplifies mechanical linkage, allows compactness. Ball and all working parts are made of stainless steel. Connections are ¾ in. Pressure ranges are 0 to 30 psi, 0 to 75 psi, and 0 to 150 psi. Send for additional information. — *Farris Engineering Corp., 563 Commercial Ave., Palisades Park, N.J.*

Rigid Vinyl Material For Pipe, Ductwork

"Koroseal" material withstands temperatures up to 200 F, and is corrosion resistant. Pipe can be cut with a saw and curved with heat to fit practically any shape. Connects with solvent cement, heat welding, or threaded couplings. Available in ½ through 6 in. sizes in schedule 40 and schedule 80. Sheets for ductwork and other applications available in 48 by 96 in. sizes and thicknesses from 1/32 to 2 in. Socket fittings, welding rod, and special solvent adhesive also available. — *B. F. Goodrich Industrial Products Co., Akron, Ohio.*

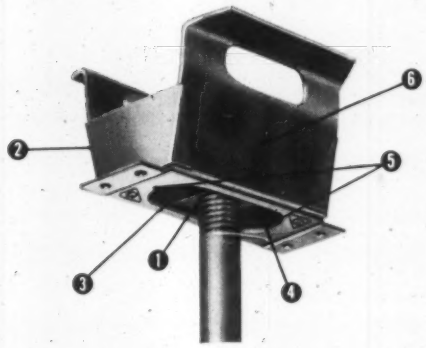
10 Ton Condensing Unit Has Capacity Control

Rooftop unit has controls to unload automatically two cylinders to produce two-thirds capacity. A time guard control circuit prevents rapid cycling of the compressor and reduces starting load on the electric system. Weighs 870 lb and stands 20⅞ in. high without legs, which adjust to 12 or 18 in. Has vertical discharge propeller type fans. Compressor and controls are in separate compartments. — *Carrier Air Conditioning Co., Syracuse 1, N.Y.*

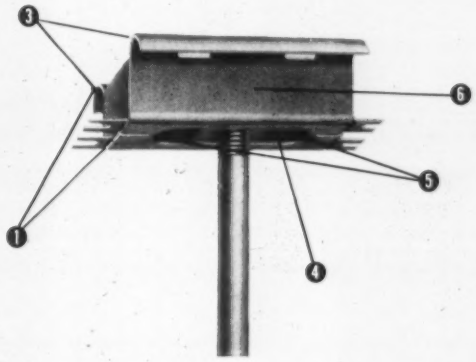
Plastic Pipe Fittings Offered in Various Plastics

Available in "Zytel" (Nylon), "Teflon," PVC, "Profax," polyethylene, "Plaskon," "Penton," Kel-F," and "Delrin." Available in a complete range of shapes and sizes from 1/16 through 1 in. nominal pipe size. Send for additional information. — *Cajon Co., 902 E. 140th St., Cleveland 10, Ohio.*

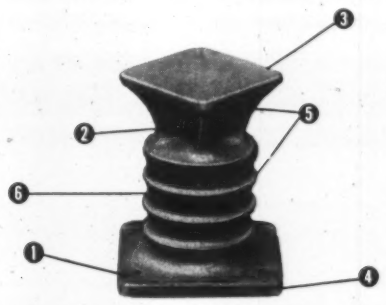
See all the extra features you get in Grinnell Concrete Inserts...at no extra cost!



GRINNELL WEDGE TYPE CONCRETE INSERT (Steel) FIG. 281 — 1. Nut and rod may be preassembled for fast installation. 2. Wedge-shaped body, held in compression by concrete, supports greater loads. 3. Elongated nut wedges against sloping sides of insert giving greater load-carrying capacity than would lower edge of insert. 4. Knockout (already removed) seals out concrete. 5. Full 1¾ inch lateral adjustment. 6. Supports up to 1200 lbs.



GRINNELL LIGHT WEIGHT CONCRETE INSERT (Steel), FIG. 285 — 1. Designed for shallow concrete, as little as 2 inches thick. 2. Extremely economical. 3. Arched flanges take reinforcing rods. 4. Knockout (already removed) seals out concrete. 5. Full 2 inch lateral adjustment. 6. Supports up to 400 lbs.



NEW GRINNELL SCREW CONCRETE INSERT (Malleable Iron), FIG. 152 — 1. Insert is firmly mounted on concrete form by nailing through four slots. No mutilation of forms from drilling special holes to hold insert. 2. Functional design . . . can be used in conjunction with reinforcing rods (rods fit under crown of cap). 3. Low over-all height helps keep insert stable when pouring. 4. Fits flush with ceiling for best over-all appearance. 5. Ribbed design, malleable iron for extra strength. 6. Supports up to 2120 lbs.

GRINNELL CB "Closed Back" CONCRETE INSERT (Malleable Iron), FIG. 282 — 1. One body size accommodates 5 sizes of rods and nuts. 2. Slot takes reinforcing rods to assure maximum load rating. 3. One-piece, closed back body prevents concrete seepage. 4. Teeth on insert and nut hold rod firmly in place. 5. Low height, broad flat bottom minimizes displacement. 6. Cast in corrosion-resistant malleable iron. 7. Supports up to 1430 lbs. (Also available in smaller "CB-JUNIOR" size that supports up to 770 lbs.).

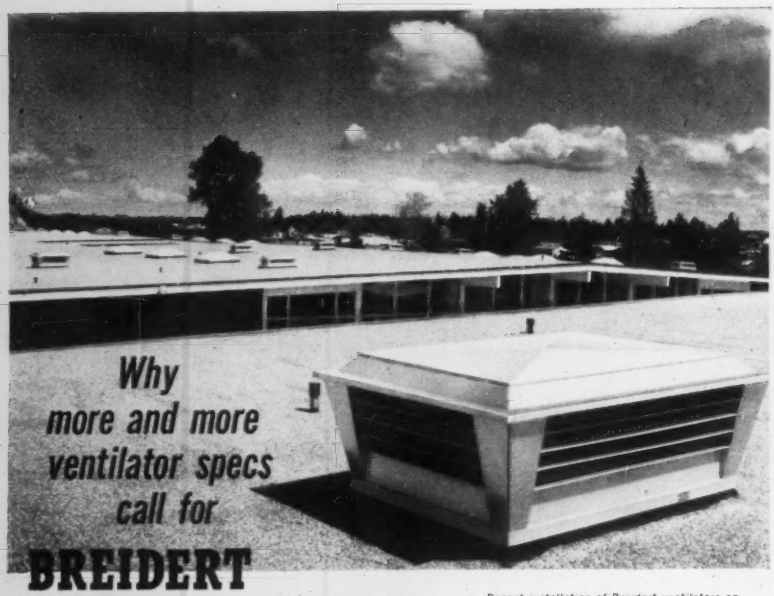
You get *more* for your money from Grinnell, because Grinnell's huge volume reduces production costs . . . lowers prices right into line with competitive inserts offering much less.

Look at all you get with Grinnell Inserts: wider choices of types and sizes . . . better quality control . . . published ratings for *all* inserts! Underwriters' Laboratories and Factory Mutual approved. Faster delivery from nationwide warehouses, too. Moreover, you receive dependable field service by trained Grinnell personnel . . . no matter how far from the job site the sale was made! Grinnell Company, Inc., Providence 1, Rhode Island. Branch warehouses in principal cities.

Remember, The Best Costs No More — from America's #1 Supplier of Pipe Hangers and Supports

Call your local Grinnell Distributor for pipe hangers, cast and malleable iron fittings, steel nipples, welding fittings, Grinnell-Saunders Valves, unit heaters – all made by

GRINNELL



Recent installation of Breidert ventilators on the Mt. Tahama School, Tacoma, Wash. Type BWR (power) in foreground; Types BWR and SG (gravity, with translucent top) in back. Robert Price, Architect... David M. Hopkins, Consulting Engineer.

BREIDERT AIR-X-HAUSTERS

BREIDERT POWAIR-X-HAUSTERS

In every section of the country, more and more architects and engineers are specifying BREIDERT AIR-X-HAUSTERS and POWAIR-X-HAUSTERS for all types of ventilating jobs. As the photo shows, BREIDERT ventilators are outstanding, with attractive low contours and square or rectangular shapes that conform handsomely to modern architectural design—an important reason for architects' growing preference for BREIDERTS.

Engineers have learned that BREIDERT ventilators, whether power or gravity, do the jobs they're rated for—unfailingly. BREIDERT capacities are certified, giving you full assurance of performance. BREIDERT ventilators are so nearly trouble-free that some engineers call a BREIDERT installation "preventive maintenance."

SAFE, SURE VENTILATION FOR EVERY PROBLEM

BREIDERT AIR-X-HAUSTERS (gravity) deliver positive, safe ventilation no matter which way the wind blows, barring interior negative pressures. BREIDERTS are unconditionally guaranteed to deliver their rated capacities when properly installed.

The complete line of power and gravity BREIDERTS, including round, square and rectangular models, is shown and described in a handsome 52-page Engineering Data Book which belongs in your files. We'll be glad to send you one. *On your next ventilating job, investigate* BREIDERTS *thoroughly*... there's a BREIDERT agent in or near your city. Consult your phone directory, your BREIDERT catalog, or write us.

THE G. C. BREIDERT CO.
13690 VAUGHN STREET, PACOIMA, CALIFORNIA
MAIL ADDRESS: P.O. BOX 1190, SAN FERNANDO

EQUIPMENT DEVELOPMENTS

Continued

Centrifugal Pumps Are Hermetically Sealed

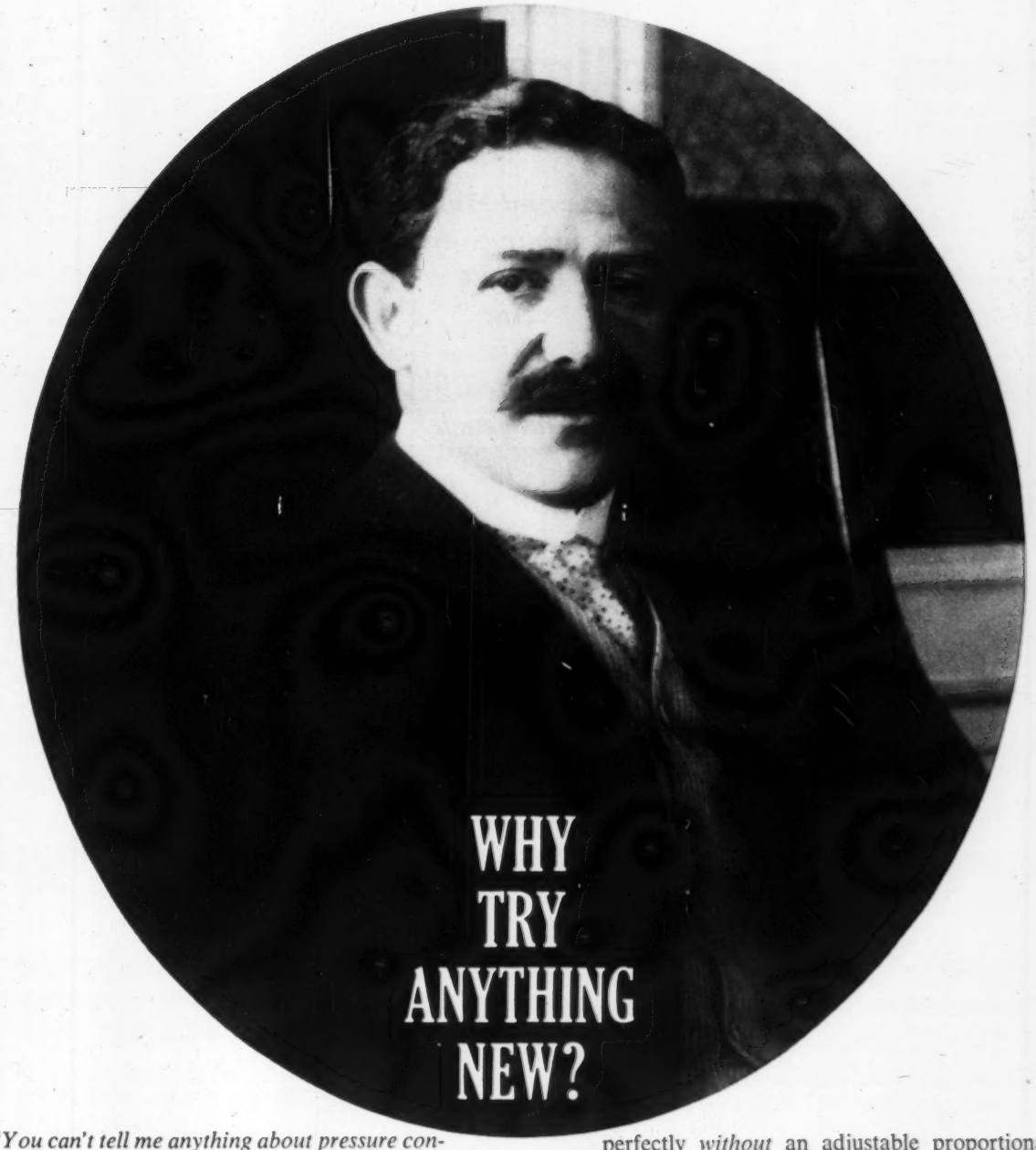
Totally enclosed pumps for use with toxic, inflammable, or highly volatile liquids. Features a self-adjusting bearing. Has no stuffing boxes or mechanical seals. Single suction units have enclosed, hydraulically balanced impellers. Available in 13 sizes, with discharges ranging from 1 to 5 in. Standard units for 120 psig and temperatures of 40 through 250 F. Other ratings available. Send for bulletin No. 977. — *Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.*

Ball Valve Features "Teflon" Covered Ball

"Con-O-Sphere" valve has a "sealing capsule" of conical-shaped "Teflon" which is molded around the ball that controls the off-on action of the valve. Has seven parts: the sealing capsule with integral handle stem, valve body, handle, stem seal, screw-in base plate, lock nut, and screw set. Sizes range from ⅛ to 2 in. for working pressures from vacuum to 1440 psi. Available in a number of metals. — *ACF Industries, Inc., W-K-M Div., Dept* 312, *P. O. Box* 2117, *Houston* 1, *Tex.*

Low Range Oxygen Analyzer For Gas Mixtures

Dual range design (0-1 or 0-2 and 0-5 percent — 0-1 or 0-3 and 0-10 percent) permits tracking while process is brought into range and provides analysis accurate to ±2 percent under normal operation. Model is not affected by the presence of hydrogen or other hydrocarbons in the background gas. Send for additional information. — *Hays Corp., 742 E. Eighth St., Michigan City, Ind.*



WHY TRY ANYTHING NEW?

"You can't tell me anything about pressure controllers. To claim that you can have stability without being plagued by a black box full of bourdon tubes, flapper-nozzles and reset contrivances is nonsense . . . plain nonsense!"

We disagree! It seems that in the bulk of pressure control systems with short lag factors, the adjustable proportional band and reset mechanisms serve chiefly as crutches. They do little more than compensate for a flapper valve's over-sensitivity to minor system disturbances. In this respect, they merely approach, without equalling, the *inherent* operating stability of the Leslie Control Pilot's forward design. (No flappers, no problems). This pilot functions perfectly *without* an adjustable proportional band in such systems.

There are instances, however, where it is prudent to specify an adjustable proportional band for a broader range of applicability. Here, your answer is a Leslie pressure pilot with a single knob proportional band adjustment. Used either as a controller or a transmitter, this combination is the leader among pressure pilots. Write today for details on fixed or adjustable proportional band Leslie Control Pilots, or both.

LESLIE REGULATORS AND CONTROLLERS

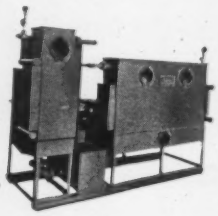
A SINGLE STANDARD OF QUALITY SINCE 1900

Leslie Co., 703 Grant Avenue, Lyndhurst, New Jersey

frost-free cooling as cold as -90 F

Consulting firms are more and more taking advantage of Kathabar engineers' specialized knowledge about frost-free cooling at sub-freezing dry bulbs and dew points. This knowledge has been accumulated in many successful applications—such as candy cooling, photo film chilling, beer fermentation, ammonium nitrate processing, environmental testing, bakery dipping and icing, and radiant panel cooling.

In all cases, Kathabar equipment eliminates freeze-ups, fluctuating efficiency, defrosting shutdowns, duplicate sets of coils.
Take advantage of Kathabar's fund of specialized knowledge . . .



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SURFACE COMBUSTION, 2384 Dorr St., Toledo 1, Ohio

a division of Midland-Ross Corporation MR

Send facts on frost-free cooling for the following application: .....

.....

name & title .....

address .....

street .....

city .....*zone* .....*state* .....

EQUIPMENT DEVELOPMENTS

Continued

Pumps Available In ¼ to 1 Hp Sizes

Designed for pumping against relatively high heads on low pressure systems. Twelve sizes available with single or three phase motors. Operate at 1750 rpm. Feature dynamically balanced closed type cast iron or bronze impellers, rubber mountings, sleeve bearings, mechanical seals, and flexible couplings. Send for additional information. — *Taco Heaters, Inc.*, 1160 *Cranston St., Cranston 9, R. I.*

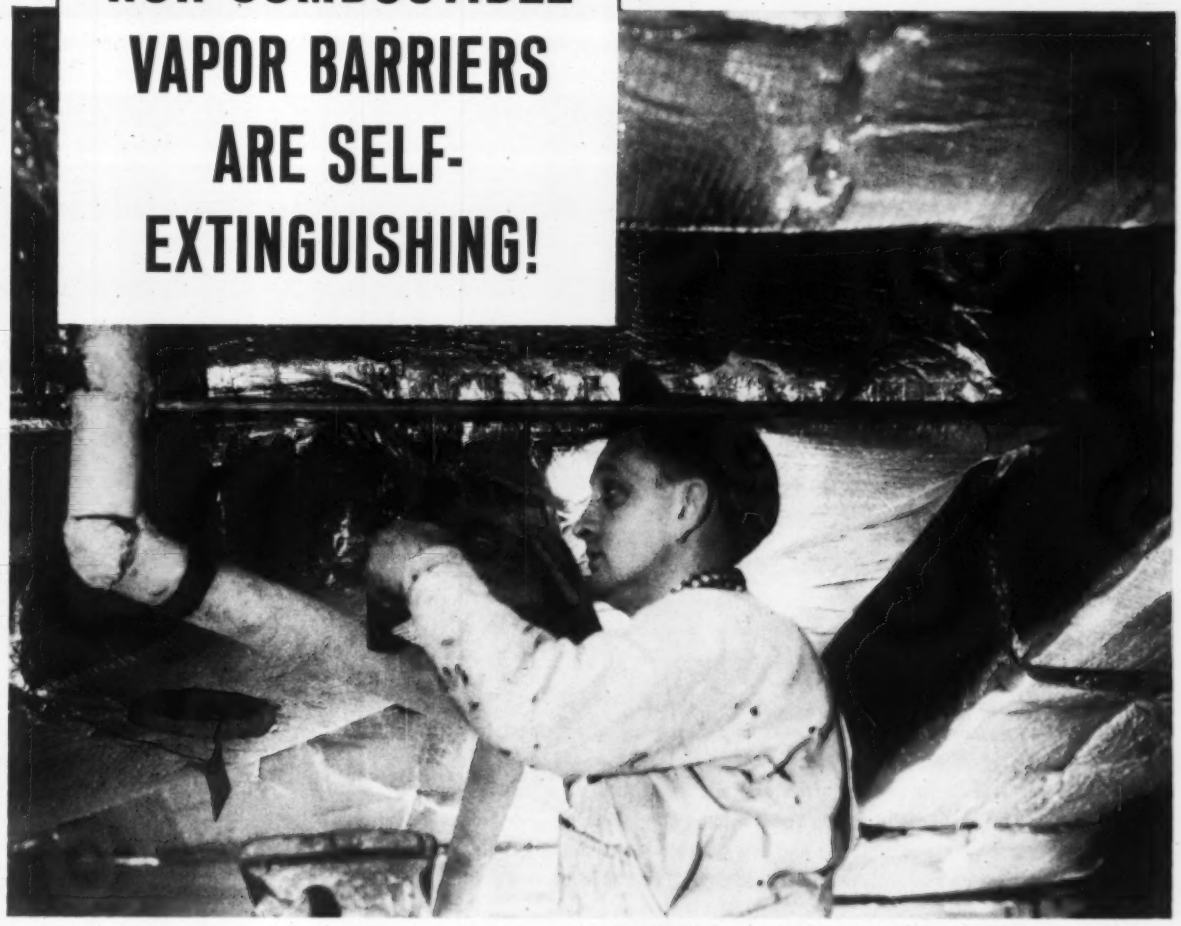
Industrial Water Treatment Kills, Prevents Algae and Fungus

Algaecide formulation composed of a mixture of chlorinated phenolic compounds is for use in cooling towers, air conditioning systems, and similar applications. Formula "D-130" kills present growths and prevents future growths. Contains no mercury, copper, or iodine. Compatible with water treatment chemicals; non-corrosive. — *The Bird-Archer Co.*, 4337 *North American St., Philadelphia 40, Pa.*

10¼ In. Baseboard Panel Compatible with Smaller Size

Steel enclosed panel matches firm's 8 in. model. Makes matching installations possible in both regular and height-restricted areas. Choice of two quick response heating elements. Has a combination splitter/damper which can be set at any interval from open to closed. Available in five lengths, 3, 4, 5, 6, and 8 ft. Has a built-in tube support. — *American-Standard Plumbing & Heating Div.*, 40 *W. 40th St., New York* 18, *N. Y.*

NEW NON-COMBUSTIBLE VAPOR BARRIERS ARE SELF-EXTINGUISHING!



Installing Pyro-Kure-faced insulation over air-conditioning ducts.

Part of our business is manufacturing vapor barriers — to stop moisture and prevent condensation. A problem: produce a superior vapor barrier that is *non-combustible*. We've done it! Called *Pyro-Kure*, it is available in rolls of various widths and in many combinations — foil, paper, plastic film. They can be reinforced for amazing strength. There is no other vapor barrier like it on the market. It is the first and only *permanent* non-combustible vapor barrier with an unqualified U/L flame spread rating.

Pyro-Kure now makes it possible for these specifications to be fulfilled: *a vapor barrier with a permanent flame spread rating: kraft side-25; foil side-5*. It is now being used by leading insulation manufacturers for insulation facings, pipe jacketing, duct lining.

If you or your firm is interested in the concept of "total fireproofness" in construction, you will want to know more about this development. Pyro-Kure self-extinguishing vapor barriers may have a use in a current project. Write American Sisalkraft, Attleboro, Mass. for a complete file of data, facts, figures and samples. No obligation.

reinforced paper, foil, plastics and other products for construction, industrial packaging and agriculture

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COST
under control

...you'll want to anchor it to masonry the most economical, most effective way. But the best way differs from job to job.

How can you find the masonry anchor and anchoring method to fasten your fixture securely, at lowest cost? Profit by The Rawlplug Company's 40 years' experience designing, testing, manufacturing, and using masonry anchors and drills. You can count on us for competent, impartial guidance...we make every important kind of anchor and drill in use today.

We've briefed this masonry anchoring know-how in a new eight-page booklet, "Install It for Less"...ask your local Rawlplug branch or distributor for a free copy of this useful publication. It will help you determine the method that's best for your masonry anchoring job, to keep "in place" costs under control.

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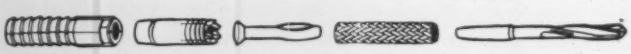


EQUIPMENT DEVELOPMENTS

Continued

Gas-Fired Unit Heaters Have Capacities to 300,000 Btuh

Propeller fan-type unit heaters available in 11 capacities from 25,000 to 300,000 Btu per hr input. Two models: one for 115 v operation; the other equipped with a 24 v transformer and fan control for low voltage use. Controls are enclosed within the heater cabinet. Aluminized steel heat exchanger standard, with stainless steel exchangers available optionally. — *Reznor Mfg. Co., Mercer, Pa.*

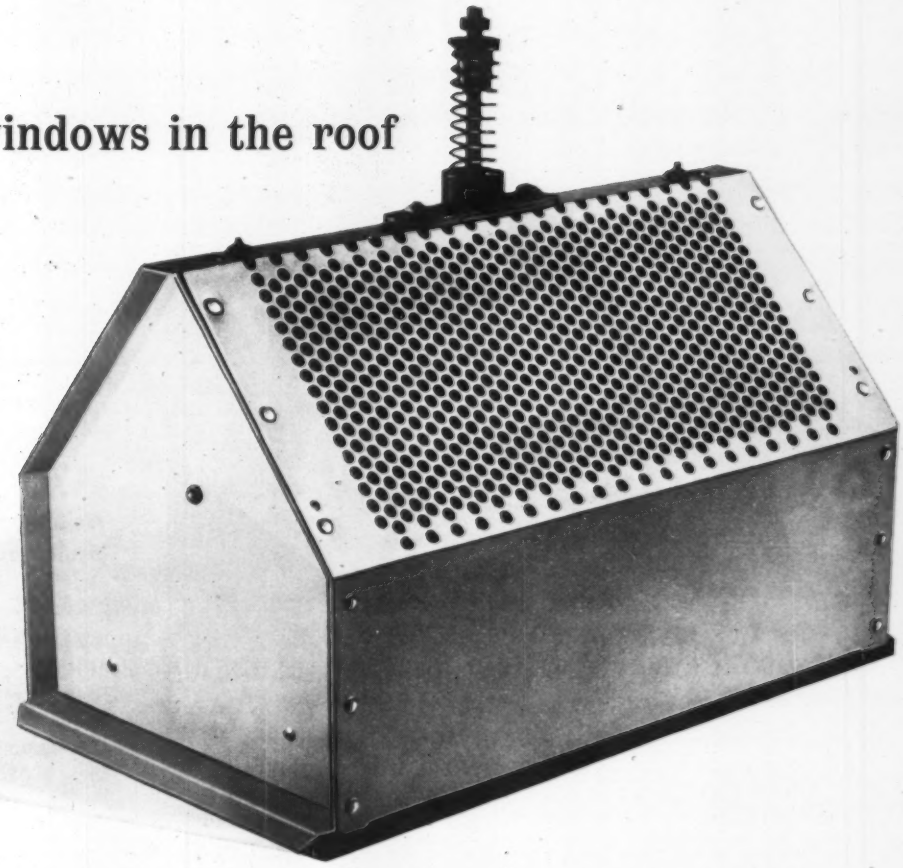
Control Valves for Cooling Water

Available in sizes from ½ through 2½ in. in capacities from 15 to 200 gpm. Send for bulletin BAM. — *Lawler Automatic Controls, Inc., Mount Vernon, N. Y.*

Boiler Water Treatment for Scale, Corrosion Resistance

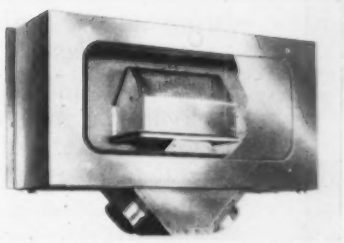
Six different chemicals are available. Liquid hydrochloric acid formulation is suited for fast removal of difficult scale deposits. Solid sulfamic acid formula is for scale removal in steam generators. "Two-Way" boiler treatment is for steam generators, reducing scale formation and inhibiting corrosion. "Three-Way" treatment is for heating systems with condensate return. The formula includes inhibitors that remain in the boiler and volatile inhibitors that travel with the condesate. Also available are a circulating water treatment for hot or chilled water, and a fuel oil additive containing a combustion catalyst, solvents, and detergents. — *Virginia Chemicals & Smelting Co., West Norfolk, Va.*

1,394 windows in the roof



This is the "doghouse" in every Dual Duct air mixing unit. Quietly and efficiently, its 1,394 window-like apertures are opened and closed automatically to maintain constant air volume regardless of static pressure variance. That means there's never a balancing problem, never a drop-off or sudden air blast resulting from activity or shut-down in other zones.

For new structure or modernization, Buensod Dual-Duct is the perfect year-'round air conditioning system . . . completely compatible with existing radiation, too.



Buensod-Stacey Type V, Under-Window Dual Duct air mixing unit.

BUENSOD-STACEY CORP. · MANUFACTURED PRODUCTS DIVISION

BUENSOD-STACEY

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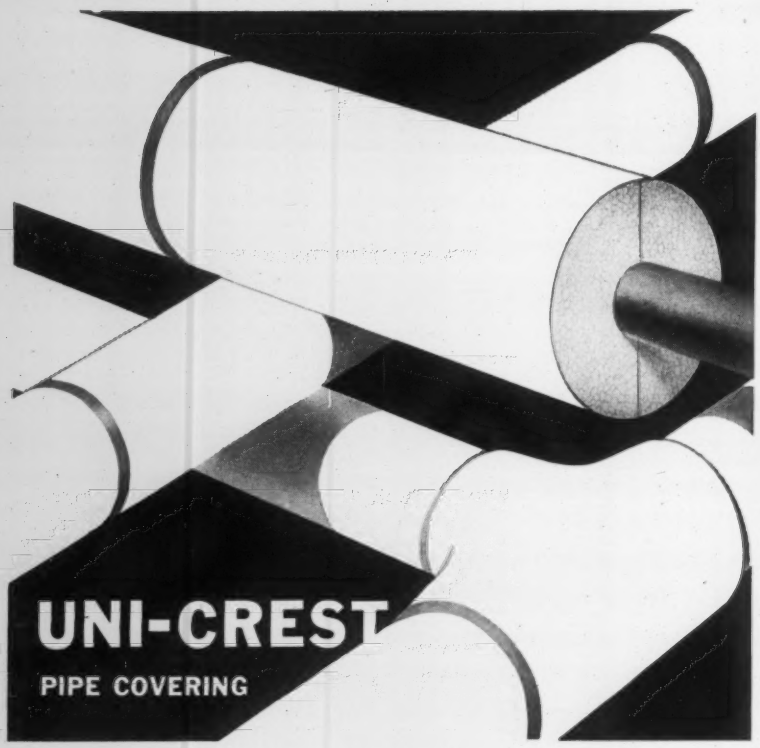

a new, economical, low temperature insulation

Uni-Crest expanded polystyrene pipe covering is an excellent low temperature insulating material, and is inexpensive to install and maintain.

Its low thermal conductivity (K factor) plus its high resistance to water and water vapor — are some of its prime qualities. It will not rot, mildew, or support fungus growth.

Extremely lightweight, with a smooth, tough white surface, Uni-Crest is non-dusting, non-flaking, and easily cut and handled on the job.

Uni-Crest and self-extinguishing Uni-Crest are available in a wide variety of sizes and shapes. Both types are also available with or without a paper and foil laminate jacket.

For the address of the office nearest you, plus additional information and an actual sample, please write to the address below.

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UNITED'S UNI-CREST EXPANDED POLYSTYRENE

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EQUIPMENT DEVELOPMENTS
Continued

Automatic Reset Timers Available in Three Types

Will delay an operation or operate a circuit for a preset time after remote pilot action. Driven by continuous running synchronous motors. Can be externally wired for use with various pilot switches. Three types available, each with a time range of 1, 3, or 5 min, 1 to 5 hr, adjustable within the range. Send for bulletin 6126. — *Paragon Electric Co., Inc., Two Rivers, Wis.*

Welding Machine Fastens Insulation Pins and Studs

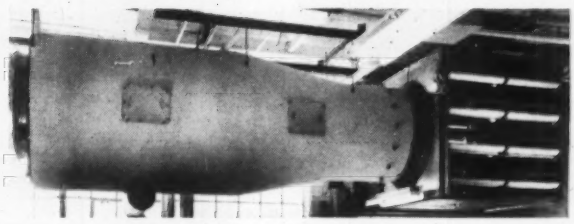
Consists of a compact welding cabinet weighing 38 lb and a pistol-grip welding gun. Power supplied from a standard 110 v a-c outlet. Welds to steel, stainless steel, or aluminum. — *Omark Industries, Inc., 9701 S. E. McLoughlin Blvd., Portland 22, Ore.*

Screens Available for Dirt, Dust, Odor Control Systems

Custom built screen units and assemblies for use on electronic dirt, dust, and odor control systems. Available in a total of 452 listed sizes among 12 types of equipment covering a range of 450 to 30,000 cfm. Modular design allows combinations to extend the listed number to 1124 sizes up to 80,000 cfm or more in one system. Screen unit consists of complete steel casing and slide-out screen assembly. Screen assembly consists of three assembled screens and a set of tracks for installation. — *Manufactured by American Statronic Corp.; distributed by CRS Industries, Inc., 1405 Locust St., Philadelphia 2, Pa.*

SUCCESS STORY

of a revolutionary air conditioning system!



CARRIER ROTASPRAY units require less than ⅓ the space of a conventional system of the same capacity—may be ceiling hung, wall cantilevered or mounted on the roof.

Six years ago Carrier pioneered an entirely new concept in air conditioning for industrial applications—the Rotaspray Weathermaker* System. It is now in operation in such widely different fields as textiles, plastics, rubber, candy, steel, cigar, paper, leather and garment. What is its record of performance? The best indication is the many repeat orders we've had . . . and are getting . . . from satisfied users. Can you use the Rotaspray System to advantage? Here are some of many reasons why it may be the best answer to new construction or reconversion problems.

UNITARY DESIGN. Instead of complete central station systems which require larger apparatus rooms, Rotaspray units are spotted conveniently throughout a plant. Only one central water handling apparatus is required.

FLEXIBLE INSTALLATION. Because of the compactness and low operating weight of Rotaspray units, they can be installed either ceiling hung, wall cantilevered or roof top mounted.

LOW MAINTENANCE. Rotaspray units incorporate self-cleaning "Cant-Clog" nozzles and a self-cleaning eliminator. Compared with large central station systems, they reduce cleaning and maintenance costs as much as 80%.

LONG LIFE. Rotaspray units are fabricated of stainless steel and other durable materials to assure years of virtually trouble-free operation.

HIGH EFFICIENCY AIR CLEANING. Each Rotaspray unit separates dust and other particles from the air . . . assures a "scrubbed clean" air supply at all times.

BETTER TEMPERATURE AND HUMIDITY CONTROL. By a new control method especially designed for the system, the old method of dew point control has been eliminated. Zoning control has also been eliminated. Each Rotaspray unit accurately controls temperature and humidity in its own area.

For complete information, write Carrier Air Conditioning Company, Syracuse 1, New York. In Canada: Carrier Air Conditioning Ltd., Toronto 14.

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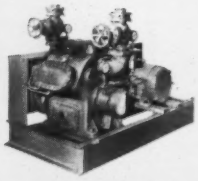
Carrier Air Conditioning Company

Summer Cooling... Winter Curling and Skating - all with ONE refrigeration system

Main entrance to Prudhomme's Garden Centre Motor Hotel in Vineland, Ontario. This exciting summer and winter playground spot uses Vilter refrigeration to good advantage.



Two 6-cyl. Vilter VMC belt-driven compressors provide refrigeration at Prudhomme's for summer air conditioning and winter curling.

The Garden Centre Theatre becomes a regulation six-sheet curling rink during the winter months. The Vilter system is designed to produce ideal curling ice at the lowest possible power cost.

Year 'round use of your refrigeration capacity is sound business and enables maximum profit to be realized from your investment.

An excellent example of the year-'round utilization of refrigeration is Prudhomme's Garden Centre Motor Hotel in Vineland, Ontario, along the Queen Elizabeth Way. At this famous motel, recreation center and convention headquarters, Vilter refrigeration plays an important role in keeping guests happy.

During the summer months, refrigeration is required to air condition the 180-room motel, one of Canada's largest, and an 1100-seat summer stock theatre which draws large crowds to see outstanding stock productions of Broadway plays. In winter months, the same equipment builds ice surfaces for a 90′ x 180′ outdoor ice skating rink and a regulation six-sheet curling rink. The summer stock theatre building is used to house the curling rink with either a seating structure installed or plastic piping laid for the curling rink, depending upon the season.

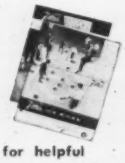
Vilter equipment installed at Prudhomme's includes two 6-cylinder VMC compressors and a 24″ x 20′ shell and tube condenser.

Vilter has had many years of experience in recommending and building refrigeration systems for air conditioning and ice rinks. This know-how, plus the use of dependable economical-to-operate Vilter equipment, can also mean a satisfying installation for you. Why not see your nearest Vilter representative today?

Sold and Installed by VILTER DISTRIBUTOR
J. L. Wilson and Sons, Limited, Toronto, Ontario, Canada

Vilter® refrigeration air conditioning

Vilter Manufacturing Corporation
Milwaukee 7, Wisconsin
Air Units • Ammonia and Freon Compressors • Booster Compressors Baudelot Coolers • Water and Brine Coolers • Blast Freezers Evaporative and Shell and Tube Condensers • Pipe Coils Valves and Fittings • Pakice and Polarflake Ice machines.



Write for helpful bulletins to Vilter Manufacturing Corporation, Dept. F-614 2217 South First Street Milwaukee 7, Wisconsin

EQUIPMENT DEVELOPMENTS

Continued

Circulator Features Constant Lubrication of Bearing

Oil is constantly fed around the pump shaft through a double spiraling grooved bearing by the rotation of the pump shaft itself. Excessive oil is spun off by nonwearing slingers; no mechanical seals are needed. Entire pump shaft, seals, and impeller can be removed by releasing the tension on one screw after the bracket has been pulled from the body. Develops a maximum head pressure of 9½ ft. Flanges of ¾, 1, 1¼, and 1½ in. sizes may be interchanged. Powered by a ⅛ hp 1725 rpm motor with thermal overload protection. — *H. A. Thrush & Co., Peru, Ind.*

Brass Fittings for Plastic Tubing Coupling

Both high and low pressure couplings available for polyethelyne and similar plastic tubing. Includes sizes of ¼, 5/16, and ⅜ in. OD with 0.040, 0.062, and 0.062 in. walls, respectively. Recommended working pressures are 136, 169, and 141 psi, respectively. Temperature rating is to 140 F. Send for brochure No. 161. — *Spanco Brass Co. Otsego, Mich.*

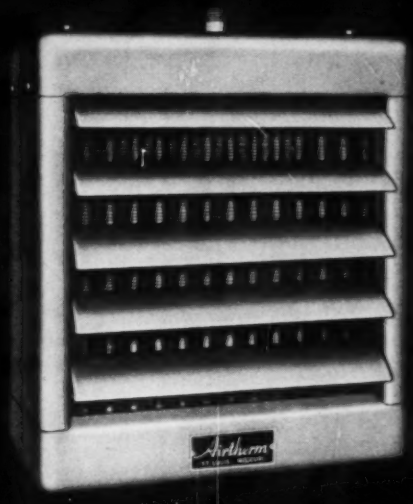
Head Pressure Control Valve For Air Cooled Condensers

To be used whenever low entering air temperatures will result in condensing head pressures too low for proper thermal expansion valve feeding and operation. Can be used on all of firm's models in the 2 through 50 ton range. Can also be used for multi-circuit condensers with two or more compressors to achieve independent control of each circuit. — *The Trane Co., La Crosse, Wis.*

GET THE FINEST *FASTEST!*

AIRTHERM

Unit Heaters

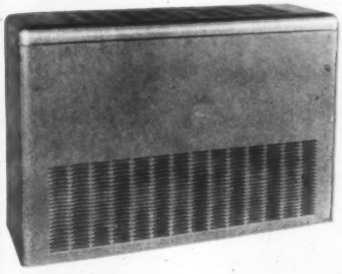


Airtherm propeller fan unit heaters can accommodate virtually every air distribution pattern, mounting height and heating requirement. Twenty-four vertical and twenty-two horizontal air delivery models . . . steam, air or hot water . . . capacities from 18,000 to 555,000 BTU's per hour.

If the job requires propeller fan unit heaters—and they're needed pronto—you can count on Airtherm for fast, dependable delivery.

Among many other advantages, Airtherm unit heaters enjoy an enviable reputation for amazingly quiet operation achieved by using resiliently mounted motors . . . expertly engineered fans and casings . . . plus particular concern for proper matching of face and outlet velocities.

Need more information? See your local Airtherm Representative or write direct.



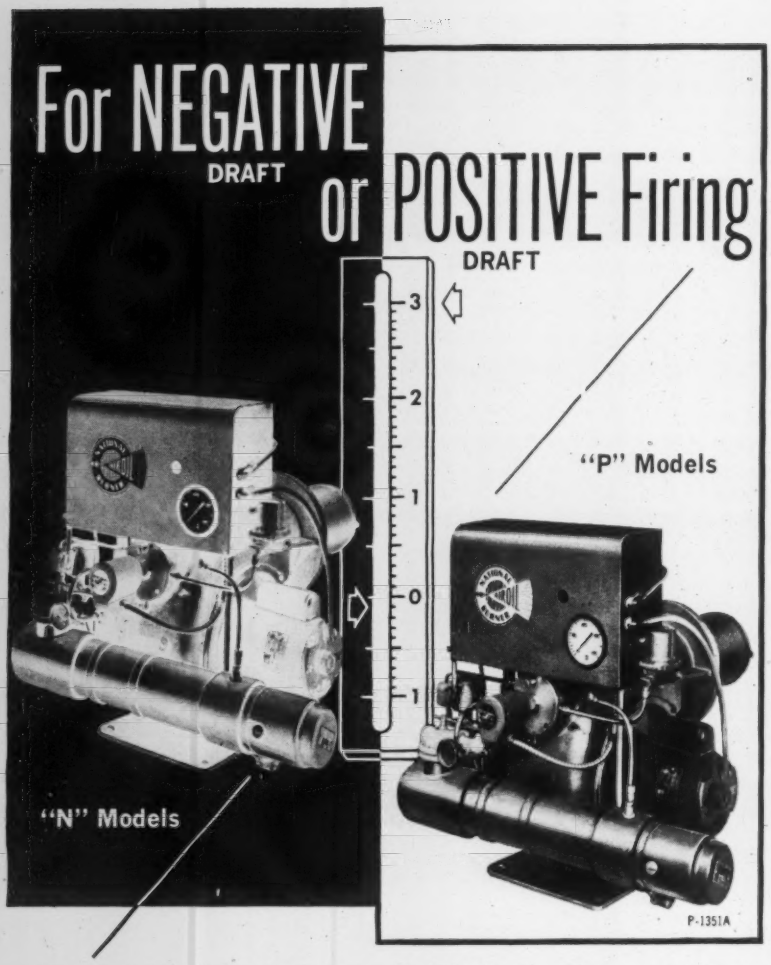
Need cabinet unit heaters in a hurry? Get them from Airtherm in just two weeks! Eight models . . . 375 to 1630 CFM . . . 124,800 BTU's per hour at standard steam ratings and 103,500 BTU's per hour hot water ratings.

WRITE FOR CATALOG!
Sixteen pages packed with information about Airtherm unit heaters. Write for catalog No. 1211.

AIRTHERM MANUFACTURING COMPANY
P. O. Box 7039 • St. Louis 77, Mo.

Heating equipment for steam & hot water; air conditioning equipment for chilled water or direct expansion

CENTRALAIRE UNITS • CABINET UNIT HEATERS • CABINET AIR CONDITIONING UNITS • VERTICAL & HORIZONTAL UNIT HEATERS • CONVECTORS



Specify National Airoil Burners

Whatever your draft requirements . . . negative or positive . . . natural or induced draft, forced draft "pressurized" . . . there are TWO National Airoil **job-engineered** burners in 14 models available for top performance under the most severe service operations.

Select **TYPE C-45** for burning **Numbers 4 and 5** commercial fuel oils . . . **"N"** models operate with a **negative** draft of 0.05″ w.c. to 21 gph, 0.075″ w.c. to 33 gph . . . **"P"** models operate against a **positive** furnace pressure up to 3″ w.c. . . quiet, easy to install, high temperature flame, excellent combustion, simple, sturdy construction, thoroughly field-tested and proved. Bulletin 100A.

Select **TYPE C-20,** a companion to the C-45 shown above, for burning the lighter **Number 2** fuel oil . . . **"N"** models operate with a **negative** draft of 0.05″ w.c. to 21 gph, 0.075″ w.c. to 33 gph . . . **"P"** models operate against a **positive** furnace pressure up to 3″ w.c. . . . clean, pulsation-free operation. Bulletin 102.

These Underwriter-approved **packaged** burners offer many outstanding first-time features. Data is contained in our comprehensive literature and specifications. Just tell us your needs and you'll hear from us by return mail.

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NATIONAL AIROIL BURNER COMPANY, INC.
1284 E. Sedgley Avenue • Philadelphia 34, Pa., U.S.A.
Industrial Oil Burners, Gas Burners and Combustion Equipment

EQUIPMENT DEVELOPMENTS

Continued

Forced Draft Boiler Has Wet-Back Construction

Scotch type boiler package includes boiler, burner, and all controls. Fired with No. 2 oil, natural, mixed or propane LP gas, or combination gas-oil. Available in seven sizes, from 60 to 165 hp, 2,000,000 to 5,540,000 Btu per hr. Low pressure unit: 15 lb steam; 30 lb water. — *Portmar Boiler Co., Inc.*, 196 *Seventh St., Brooklyn* 15, *N. Y.*

Diaphragm Valves Have "O" Ring Construction

Single seat pressure reducing diaphragm valves for working pressures to 300 psi at 500 F in a brass-body model, and 600 psi in a steel-body model control pressure of steam, fuel oil, water, gas, or air. Can also be used as pump governors, and are available in reverse acting models. Send for catalog sheet No. 171. — *Atlas Valve Co.*, 280 *South St., Newark* 14, *N. J.*

Linear Control Protects Baseboard Heating Element

Built-in automatic linear heat-limiting device protects the entire length of the heating element. Operates on restriction of air flow; does not permit the heater to exceed safe normal operating temperature, but by cycling on and off, maintains the area heat. When air blocking material is removed, device returns temperature control to the thermostat. Available in modular systems for commercial and industrial installations. — *Markel Electric Products, Inc.*, 145 *Seneca, Buffalo, N. Y.*

NOW! 3 ways to judge superior design in the NEW KENNARD NELSON unit heater!

1 New High-Efficiency 2-Way Coil—Steam or Hot Water

2 Supply-Return Tappings On One Side of Unit

3 New Compact Cabinet Design Provides More Headroom

This is the new Kennard/Nelson Unit Heater. Its unique double-duty coil combines the optimum heat transfer requirements for *both* steam and hot water systems. The new Kennard/Nelson coil design permits the highest possible capacities and widest ranges available with *either* heating medium.

The unit is specially designed for easy installation. Supply and return tappings are conveniently located on the same side of the unit. This arrangement cuts piping and labor costs, makes snug ceiling and wall mountings possible, and gives a pleasing, uncluttered appearance. Compact cabinet design also provides more headroom.

Clip and return the coupon for complete information on the new Kennard/Nelson Unit Heater with its double-duty coil. Mail to: Engineered Air Systems Division, American Air Filter Company, Inc., 373 Central Ave., Louisville 8, Ky.

AAF **American Air Filter**
BETTER AIR IS OUR BUSINESS

Mail this coupon TODAY!

Please send me complete information on the new Kennard/Nelson Unit Heater.

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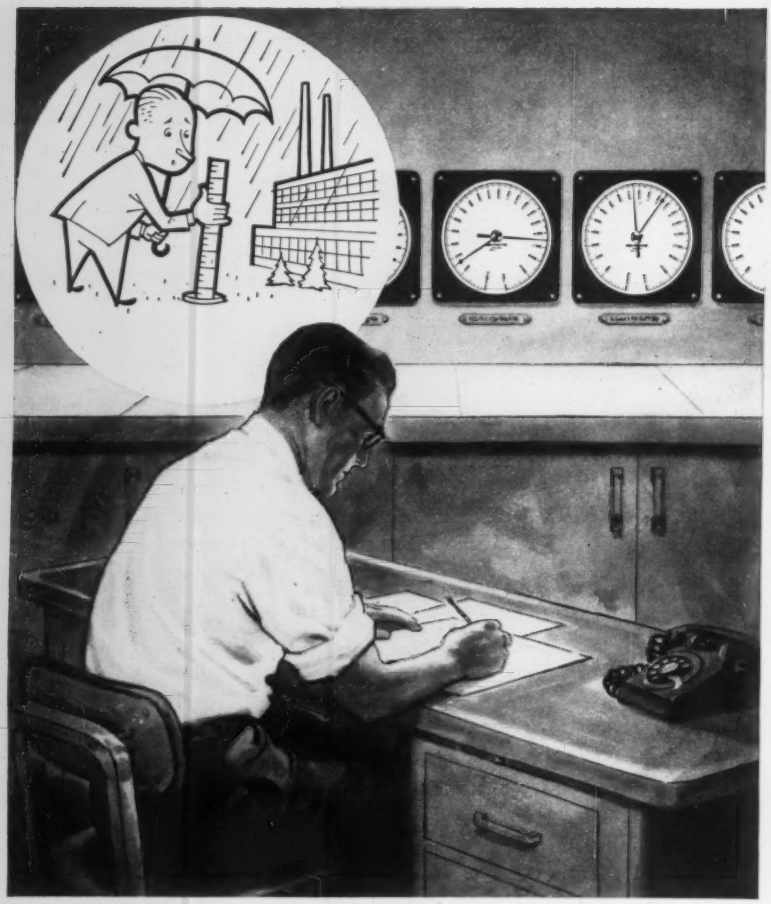


Take the legwork out of liquid measurement

Here's practical liquid measuring—the modern way... without roaming all over the lot! Liquidometer Gauges let you inventory distantly stored liquids at a glance.

Completely automatic Liquidometer Gauges can be located as far as 250 feet from tanks. Think what this centralized system can mean in man-hours saved—let alone the additional safety of personnel who no longer have to trudge to, or tamper with, hard-to-get-at tanks.

Simple to install, and requiring no maintenance, Liquidometer Gauges measure virtually all liquids conveniently, continuously, and correctly. There's a type available for practically every liquid measuring application.

For complete details, write

LIQUIDOMETER INSTRUMENTS

THE LIQUIDOMETER CORP.

Dept. A, LONG ISLAND CITY 1, NEW YORK

EQUIPMENT DEVELOPMENTS

Continued

Nozzle Changer for Oil Burner Servicemen

Can be used with both 3/4 and 11/16 in. adapters. Handles withstand torque up to 750 in.-lb, according to preliminary destructive torque test indications. Send for additional information. — *Delavan Mfg. Co., Heating Div., 811 Fourth St., West Des Moines, Ia.*

Oil-Fired Portable Heater Has 80,000 Btuh Capacity

Produces from 20,000 to 80,000 Btu per hr in a jet stream that throws the heat out 25 ft. Weighs only 46 lb. Consists basically of a combustion chamber, 800 cfm fan, built-in 5 gal fuel tank, modulating control, and a starting switch. — *Stow Mfg. Co., 350 Shear St., Binghamton, N. Y.*

Brass Fitting Provides Seal on Polyethylene Tubing

Consists of a brass "Swagelok" tube fitting body with "Zytel" ferrules and a brass, knurled nut. Suitable for vacuum or pressure applications. Features a wrench pad on the nut to prevent damage. Available in sizes of 1/4 and 3/8 in. OD tubing. — *Crawford Fitting Co., 884 E. 140th St., Cleveland 10, Ohio.*

Damper Regulator Has Integral Locking Device

Provides close tolerance air balancing in all heating, air conditioning, and ventilating systems. Permits adjustment by one operator. Send for additional information and bulletin. — *R.I.N.C.O., P.O. Box 453, Altadena, Calif.*

DON'T COMPARE

insul-fil®

WITH ANY OTHER FILL-TYPE INSULATION!

insul-fil Is A Reinforced Hydrocarbon Fill

There's a big difference — a tremendous difference between Insul-fil and all other fill-type insulations for underground piping. Only Insul-fil has the exclusive patented perlite filler that eliminates flow. Insul-fil installations have proven themselves by standing up under all kinds of conditions where other fill-type insulations have failed.

It is a well-known fact that bitumens will flow when subjected to heat or pressure. Even hard bitumens which do not flow will crack when cool.

But Insul-fil, with its perlite filler, is completely different and infinitely more efficient in thermal stability and insulation value. It provides greater structural stability even when used at maximum temperatures.

Perlite Aggregate In INSUL-FIL Makes All The Difference

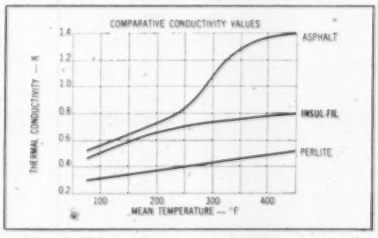
A unique combination of high softening point petroleum asphalt blended with coated inorganic perlite, Insul-fil provides far greater insulation value than any unfilled asphalt. Perlite, made from a volcanic rock which has been crushed, screened and expanded at a very high temperature, is composed of glass-like beads or perls. Each perl contains a maze of "sealed" dead air cells which give Insul-fil its light density and high insulation value. The patented process, developed for waterproofing the perlite, makes Insul-fil far superior in water resistance. In addition, another exclusive Insul-fil development is priming of pipe with Primer #7591, which provides continuous adhesion of Insul-fil to pipe, speeds consolidation, and gives positive protection against corrosion by galvanic action.

INSUL-FIL Most Effective Of All Fill-Type Insulations For Underground Piping

Field installations and all types of conclusive testing prove Insul-fil by far more effective in insulation value.

After Insul-fil is installed and heat is introduced into the lines, the Insul-fil is formed into a homogeneous consolidated mass consisting of a small plastic area of varying thickness at the pipe wall, an accompanying sintered area, and in the lower temperature range an area of unsintered material immediately adjacent to the soil.

Unlike the 100% asphalts, Insul-fil does not crack and craze from thermal shock when the heat is turned on or off and therefore does not provide access for water to the pipe. It is during the critical shut down period of spring and summer when cold pipe is especially subject to corrosion that Insul-fil is so highly water resistant.



Yes! There's a big difference between Insul-fil and all other fill-type insulations for underground piping.

INSUL-FIL Most Economical Of All Fill-Type Insulations For Underground Piping

1 — Comparative cost analysis between Insul-fil and other types of underground conduit proves Insul-fil in place costs substantially less.

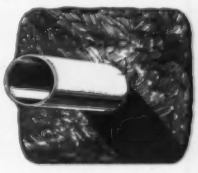
2 — Insul-fil weighs 30% less than other materials, and therefore costs less to ship, less to handle, less to install.

3 — Insul-fil is simple to install. The material is all in one package — 2 cubic feet weighing approx. 57 lbs. Insul-fil Primer supplied free of cost is applied to the surface of the pipe. The loose Insul-fil is poured from the bag around the piping to be insulated, well prodded and tamped, then the trench is backfilled. As simple as that. Heat introduced into the system forms the conduit. Thus labor for installing Insul-fil requires no special skill. The application is a simple, one trade operation.

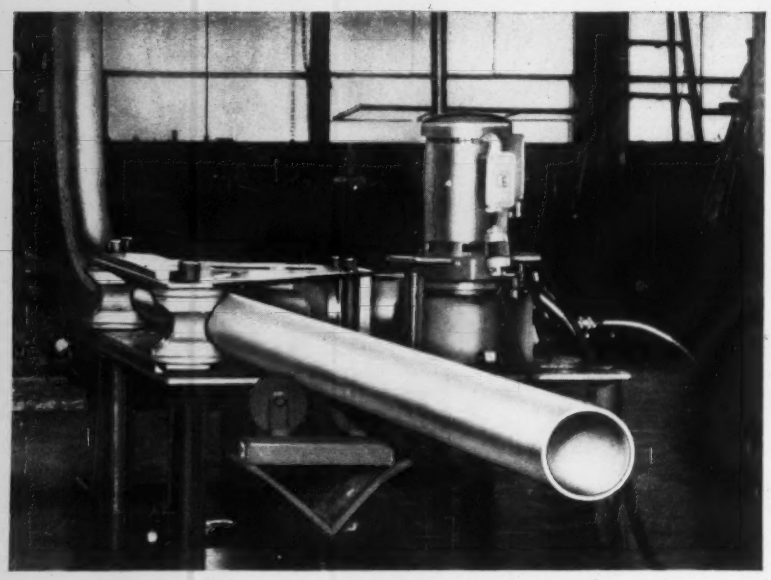
Insul-fil keeps on saving you money, with its effective control of heat loss and pipe corrosion, eliminating maintenance. Field changes in the installation of Insul-fil underground systems can be made easily, without changes in the material or its application.

Yes! There's a big difference between Insul-fil and all other fill-type insulations for underground piping.

FREE: 40-page Technical Data Book, complete with engineering drawings, heat loss curves, and installation specifications.



insul-fil COMPANY, INC.
DIVISION OF: **MIRACLE ADHESIVES CORPORATION**
250 PETTIT AVENUE, BELLMORE, LONG ISLAND, N. Y.



"We reduced bending time 80% on 4" schedule 40, 316 stainless pipe with a GREENLEE BENDER,"

St. Louis fabricating shop reports

Corrigan Company, St. Louis, Missouri, reports that a bend as shown above formerly required four hours "prefabing" and welding time using fittings, couplings, etc. Using the Greenlee No. 884 hydraulic pipe bender, Corrigan now makes the same bend in 45 minutes—a saving of 80%.

According to the plant superintendent at Corrigan, "the Greenlee No. 884 makes it easier for us to bend and prefab. Also, when we weld, the bends often pull out of square. This is not true with our Greenlee bender. Leaking problems experienced with fittings and couplings also were eliminated."

Greenlee No. 884 hydraulic benders make bends up to 90° with one ram stroke in 10 sizes—½ to 4" of steel and aluminum pipe. When operated by a Greenlee hydraulic power pump, such as the No. 1722-SA shown in use above, the No. 884 makes 90° bends in 4" pipe in less than 2 minutes. The bender also may be operated by a Greenlee No. 1726 hand pump.

Are you missing important timesavings like these on your bending jobs? Ask your Greenlee distributor to help you select the exact bender needed to streamline your operation, help you control costs, and assure maximum return for your tooling dollar. Or, if you prefer, write for Bulletin E-240A.

GREENLEE TOOL CO., 1997 Columbia Ave., Rockford, Ill.

GREENLEE JOB-PROFIT TOOLING

. . . cost control for contractors

EQUIPMENT DEVELOPMENTS

Continued

Infra-Red Electric Heater Directs Heat Where Needed

Swivels up or down to direct the heat where it is needed, the 800 w, 120 v unit reaches peak temperature in 1 min. Features a fused quartz heating element, unaffected by rain, snow, or other moisture. Unit is 26 in. long and 5 in. high. — *Pinco, Inc., 1144 S. Kostner Ave., Chicago, Ill.*

Construction Material For Ducts and Hoods

"Kaylite" can be formed and fabricated by methods common to the sheet metal and plastic practices, and can be joined to itself by chemical adhesives as well as the hot-air welding method for thermoplastic materials. Applications include air conditioning ducts and chemical hoods. Can also be used as anti-corrosive wall protection. Send for data sheets and fabrication instructions. — *Kaykor Products Corp., Yardville, N. J.*

Chemical Feed Pump Has Automatic Operation

Automatically delivers and meters corrosion control chemical and other fluids of a similar nature. Features a straight-through pumping member; has no pockets to trap air and cause non-uniform metering. Available in two models: one with a rated capacity of 1 gph at 0 to 15 psi; the other with 0.8 gph at 15 to 100 psi. Packless design pumping element and check valves made of synthetic rubber. — *Clayton Mfg. Co., P.O. Box 550, El Monte, Calif.*

EQUIPMENT DEVELOPMENTS

Continued

Chemical Cleans Oil Burner Without Disassembling

Cleans high and low pressure gun type burners and rotary vaporizing burners in approximately 15 min. without disassembling and manual cleaning. Chemical is fed through a simple feeder assembly (provided) to remove sediment from pumps, pump strainers, regulators, cut-off valves, nozzles, oil lines, and constant level valves. Send for additional information. — *Stewart-Hall Chemical Corp., 222 Washington St., Mount Vernon, N. Y.*

Sealed Glass Windows for Viewing Inside Sealed Equipment

Clear glass windows for use wherever visual observation is required (meter and light indicators, fluid level, etc.) inside hermetically sealed electronic, electrical, or mechanical equipment. Available with either Kovar or compression type seals. Send for additional information. — *Electrical Industries, 691 Central Ave., Murray Hill, N. J.*

Grey Plate Glass for Curtain Wall Construction

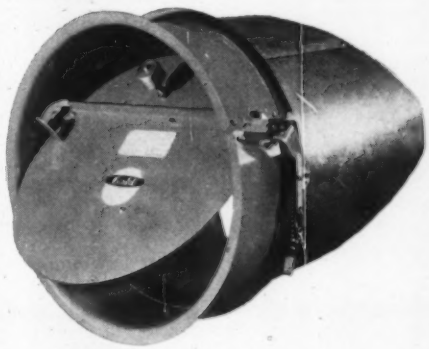
Permits control of glare and heat through large glass areas. Transmits approximately 50 percent of average daylight and 52.2 percent of total solar radiation. Available in 13/64 in. thicknesses with a maximum size of 84 by 120 in. Send for additional information. — *Libbey-Owens-Ford Glass Co., 811 Madison Ave., Toledo 1, Ohio.*

to correct

DRAFT SHORTAGES

in

GAS BOILERS



install double-acting

field

DRAFT CONTROLS

Replace your draft diverters with modern Field Draft Controls. A Field makes the draft assistance of the chimney available to the boiler for abundant draft at all firing rates, precisely controlled to the optimum twelve-to-one air-to-gas ratio recommended for clean, bright, efficient gas combustion. For 5″ through 34″ flues. Write for specification data.

Specify Field Draft Controls for gas, gas-oil, oil or coal, for boilers, furnaces, incinerators, with natural, forced or induced draft, 5″ through 34″ flues.

FIELD CONTROL DIVISION

Conco Engineering Works, Inc., Mendota, Illinois

AFFILIATES: Spartan Tool Division — Powered Sewer Cleaning Equipment
Materials Handling Division — Cranes, Hoists
Conco Building Products, Inc. — Brick, Tile, Stone
Chicago Tramrail Division — "Trak-Rak" Stacker Cranes, Monorail Systems, "Fas-Lok" Storage Racks.

Here a drain elbow and a reducer form the "bodies" for DURABLA *Basic-Check* Units. As indicated, they will operate in any position . . . can be used with most standard fittings.

Put this check valve ANYWHERE in existing piping

The DURABLA *Basic-Check* Unit* is the most convenient check valve you can use, since it installs in existing piping anywhere you please. Combined with almost any standard fitting—like the drain elbow or reducer shown—it becomes a complete check valve suitable for the widest variety of services.

It operates freely in any position. Thus it can be installed without changes in existing lines, or costly "positioning" in new installations. Means cleaner designs, too, because there are no demands on space.

These stainless-steel valve units will handle practically any liquid, gas or air . . . come in seven standard line sizes from ⅜" to 2".

For full details, send for booklet HPA101

DURABLA MANUFACTURING CO.
114 Liberty Street, New York 6, New York

DURABLA®

Manufacturers of DURABLA sheet packing, gaskets and pump valves.

*The DURABLA *Basic-Check*® Brand Unit is covered by U. S. Patent No. 2,649,277 and Canadian Patent No. 549,618.

DM-42

EQUIPMENT DEVELOPMENTS

Continued

Portable Heater Delivers Heat in 3 Sec

Fired by kerosene or No. 1 fuel oil, and puts out 75,000 Btu per hr in circulating warm air. Controlled by plugging into and out of any 115 v electric outlet. Will run 10 hr steadily; with an optional thermostat will run 15 to 20 hr. Send for additional information. — *Master Vibrator Co.*, 1752 *Stanley Ave., Dayton* 1, *Ohio.*

Perimeter Baseboard Heaters Have 277 V Electrical Rating

The 277 v circuit permits lower amperage over a smaller wire. Unit features a ¼ in. mesh grille at the top and bottom, preventing combustible objects from coming in contact with the heating element. Heat output is 250 w per ft. Maximum panel face temperature is 130 F. Rigid metal enclosure has front panel of heavy metal equivalent to 20 gage metal. Can be adapted to any angular contours. — *Wesix Electric Heating Co.*, 390-1*st St., San Francisco* 5, *Calif.*

Hydraulic Pump Cleans Capillary Tubes Without Removing

Builds up hydraulic pressures in excess of 15,000 psi to clean capillary tubes. Cleaning does not require tube removal nor cause loss of refrigerant in most systems. Unit is 8½ in. long and weighs 1½ lb. Send for additional information. — *Southgate Tool & Die Co.*, 13116 *Southgate Ave., Southgate, Mich.*

EQUIPMENT DEVELOPMENTS

Continued

Temperature Control Features Small Size

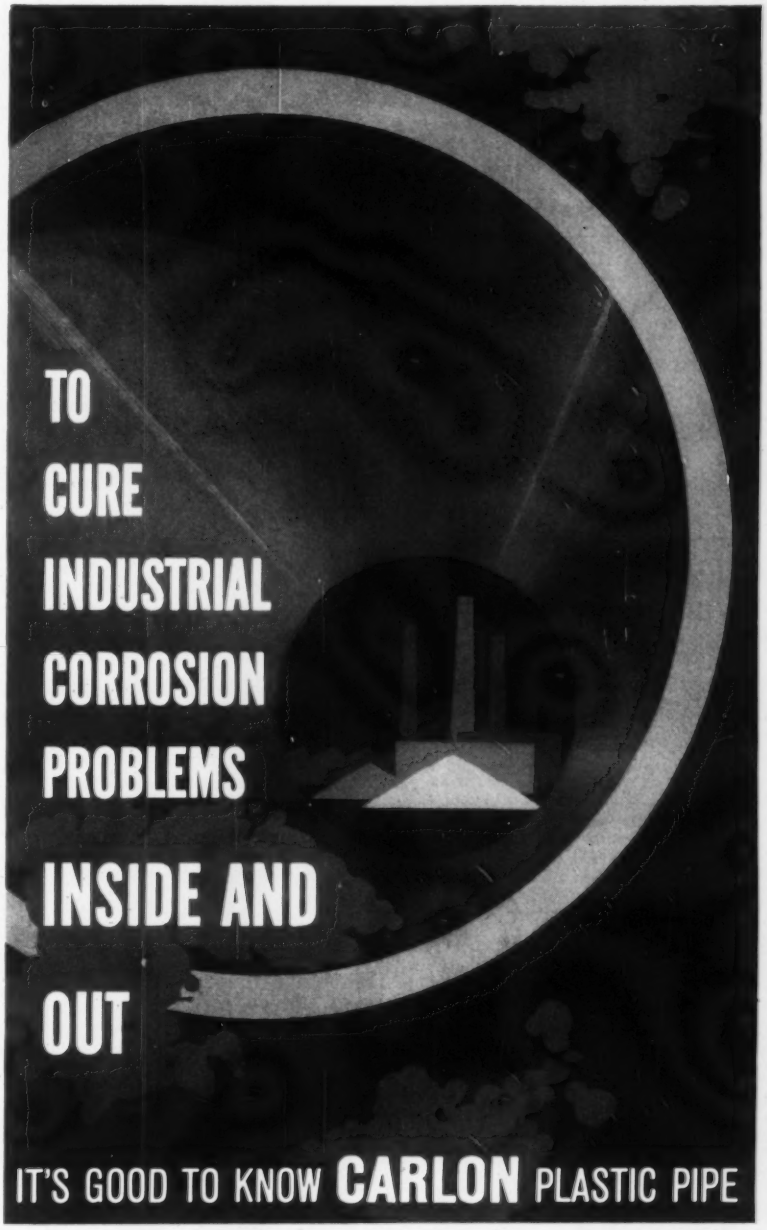
Small size (4⅛ by 4-7/16 by 2-⅞ in.) enables mounting where limited space is available. Features external adjustment, repetitive trip point, visible calibrated dial with pointer, and a visible on/off hermetically-sealed mercury contact. Adjustable operating range is 15 to 55 F. Differential (fixed) is at 2½ F. Rated at 4 amp, 115 v; 2 amp, 230 v; a-c or d-c. Provides single pole, cut in high (close on rise), single pole, cut in low (open on rise), or single pole, double throw operation. Send for bulletin 0-28. — *The Mercoid Corp., 4201 Belmont Ave., Chicago 41, Ill.*

Two-Way Radio Has 25 Mile Range

Transmitter and receiver are constructed with harness-type wiring (no printed circuitry). Does not require tuning or technical knowledge to operate. Power consumption is 5.5 amps on 12 v, d-c, or 55 watts on 115 v, a-c. Has a single crystal per channel for both transmitting and receiving. Shipping weight is approximately 15 lb. — *Hallmark Instruments Corp., 2215 Commerce St., Dallas, Tex.*

Chain Wrench Has Double Jaw Construction

Accommodates ⅛ to 4 in. pipe, featuring rachet-like action in either direction. Double jaw construction allows wrench to be operated in either direction without removal. Requires ¾ in. clearance. The handle is an alloy steel forging. Both the handle and jaw are nickel-chrome plated. — *Ridge Tool Co., Elyria, Ohio.*

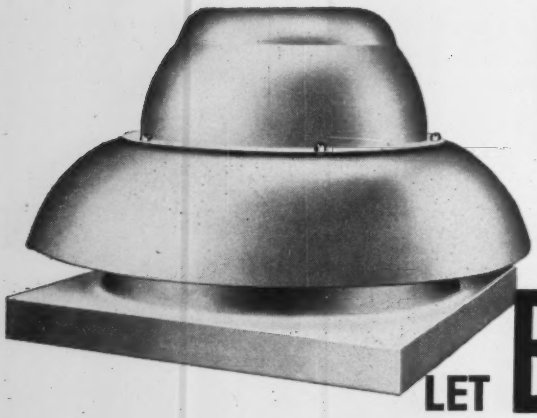


Carlon's new Plastic Pipe Fact-pak can save your company money. Includes chemical resistance tables, operating temperatures and pressures. *Write for yours.*

KNOW THE FIRST NAME IN PLASTIC PIPE
CARLON

CARLON PRODUCTS CORPORATION
Box 133 — Aurora, Ohio — Dept. HP-6
Please send me the new Plastic Pipe Fact-pak.

NAME_____
TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____



Send for FREE Data Book

LET **BURT**

MAKE AIR WORK FOR YOU

391 Standard Models To Choose From
PLUS Complete Facilities To Design
And Manufacture Special Ventilators

BURT VENTILATOR	TYPE	CAPACITY (CFM)	SIZES	MODELS	DISCHARGE
FREE-FLOW GRAVITY	Gravity	113 to 35,560	16	16	Upward
LO-HYT GRAVITY	Gravity	AS REQUIRED	18	18	Downward
MONITOR	Gravity	MADE TO ORDER		1	Upward
MONOVENT (Ridge)	Gravity	48 to 5,184	15	15	Upward
REVOLVING	Gravity	123 to 10,931	17	17	Sideward
STANDARD GRAVITY	Gravity	35 to 24,890	19	19	Upward
THERMAVENT	Gravity	MADE TO ORDER		2	Upward
CENTRIFLOW	Power	65 to 36,430	56	184	Downward
FREE EXHAUST FAN	Power	5,000 to 75,550	7	17	Upward
FREE FLOW FAN	Power	1,040 to 99,050	15	35	Upward
LOW TYPE	Power	337 to 47,400	15	60	Downward
STANDARD FAN	Power	685 to 15,000	10	10	Upward

There is a type of Burt Ventilator to meet any ventilating problem that Roof Ventilators can solve. Burt's specialized engineering, equipment and craftsmanship—from 60 years of designing and building ventilators—is your assurance of complete satisfaction. Cost economies are assured from almost 400 *standard* models that are quickly available.
Write for Burt's Complete Line Data Book—it's free!

VENTILATORS • LOUVERS • SHEET METAL SPECIALTIES

The Burt Manufacturing Company

41 East South St. **Akron 11, Ohio**

MEMBER AIR MOVING & CONDITIONING ASSOCIATION, INC.

RECENT TRADE LITERATURE . . .

Packaged Hot Water Boiler

Bulletin No. 1265 describes unit for forced circulation hot water heating systems. Features side located furnace which assures positive circulation. Boiler feed injection and natural thermal circulation augment each other. Three-pass design boiler has 5 sq ft of heating surface per boiler hp. — *Orr & Sembower, Inc., Reading, Pa.*

Pipe Insulation

Eight page brochure IN-217A describes an integrated pipe insulation that combines metal jacketing, high temperature calcium silicate insulation, and moisture barrier. Front and back covers are printed on the same type of aluminum, in a thinner gage, as is used on the "Metal-On" insulation system. Shows installation photos. — *Johns-Manville, 22 East 40th St., New York 16, N.Y.*

Sealless Pumps

Four page bulletin 52B8471B describes "Electri-Cand" pumps for handling problem liquids. Liquids flow through the motor, serving as a cooling agent and lubricant. Corrosion resistant sealing cans contain the liquid and protect vital motor components. Available in sizes from 1 by ¾ in. to 3 by 3 in., with capacities to 600 gpm, heads to 275 ft, pressures to 200 psi, temperatures to 200 F with standard insulation, 400 F with special insulation. Rated at ½ through 25 hp. Bulletin includes a list of typical solutions successfully handled by pumps. — *Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee 1, Wis.*

RECENT TRADE LITERATURE

Continued

Heating and Ventilating Units

Thirty-two page catalog describes units for steam and hot water heating systems. Units provide heating from 47,000 to 2,990,000 Btu per hr with air capacities of 1500 to 32,000 cfm. Contains selection charts for steam and hot water coil capacities, fan-motor ratings, and dimensional data for all models and sizes. — *Carrier Air Conditioning Co., Syracuse, N.Y.*

Centrifugal Fans

Forty-eight page bulletin No. A-1401 gives data on "Sirocco" fans, class I and II. Available in 15 sizes, single inlet, single width design, and 12 sizes, double inlet, double width design. Discusses drive arrangements, control methods, and types of drive. Includes capacity tables, line drawings keyed to dimensional data, and typical specifications. — *American-Standard Industrial Div., Detroit 32, Mich.*

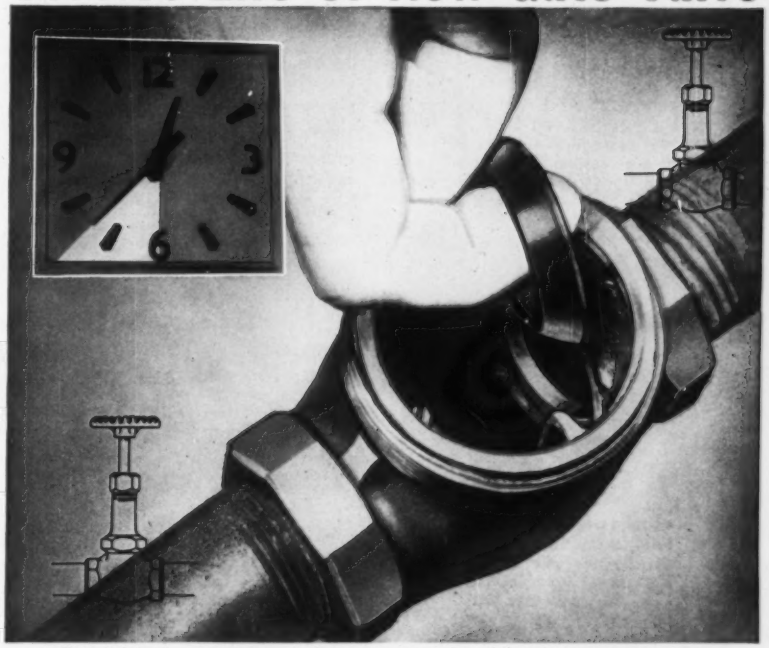
Air Filters

Series of fact sheets present design and application data on air filters. Intended for use with firm's air filter handbook, which may be obtained with fact sheets. — *Farr Co., P. O. Box 90187, Airport Station, Los Angeles 45, Calif.*

Air Velocity Meters

Twelve page bulletin No. 2448 presents data on a direct reading air velocity meter and other air measuring instruments. Accurate readings can be taken as low as 20 fpm and as high as 24,000 fpm. Special scales in metric units, mph, or knots can be provided. Illustrated with photos and line drawings. — *Alnor Instrument Co., 420 N. La Salle St., Chicago 10, Ill.*

Only 7 to 10 Minutes to Renew Service Life of New Gate Valve



Patented development assures replacement of seat ring while valve remains installed.

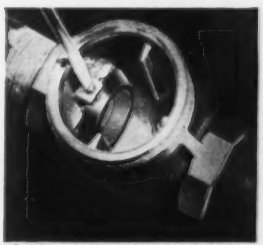
Without removing the valve body from the line, you replace the nickel-alloy seat rings in Fairbanks new patented Renewable Seat Ring Gate Valves. In 7 to 10 minutes, from the time the line is shut down until it is put back into operation, you have given a new service life, a new life of dependable tight closure to your valve.

Just 7 to 10 minutes of your maintenance man's time — only 7 to 10 minutes of "down-time" on your steam, water or process piping lines — and you have the equivalent of a new valve in the line. Think of the savings: where once at least one hour, under the most ideal conditions, was required to replace a gate valve in the line, the job is now accomplished in from 7 to 10 minutes.

Field tested for over two years, under all conditions from steam to corrosive liquids, the revolutionary new Fairbanks Renewable Seat Ring Bronze Gate Valve has proven completely satisfactory — absolutely dependable.

Made with either rising stem or non-rising stem construction in ½", ¾", 1", 1¼", 1½" and 2" sizes, the Fairbanks Renewable Seat Ring Bronze Gate Valves are recommended for severe service conditions on 200 lb. steam pressure at 550 degrees F., 400 lb. water, oil or gas pressure — non-shock — lines requiring full flow and subject to frequent operation. Nickel alloy seat rings and wedge make the valves particularly tough and corrosion resistant.

YOURS ON REQUEST: Illustrated, descriptive folder gives complete information on Fairbanks Renewable Seat Ring Gate Valve with details and specifications. Yours without charge. Write today.



1. Union Bonnet removed. Retaining screw loosened with ordinary screwdriver.

2. Finger hooks inside nickel alloy seat ring. Seat ring lifts out of valve body.

3. New seat ring is inserted. Retaining screw tightened. Bonnet replaced.

THE **Fairbanks** COMPANY
393 Lafayette Street, New York 3, N. Y.
Branches:
New York 3 • Boston 10 • Pittsburgh 22 • Rome, Ga.
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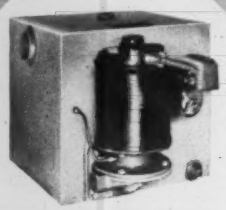
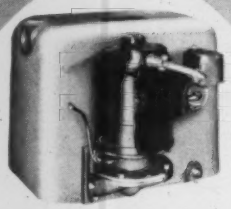


4100 Series STEEL TANK
Efficient operation . . . neat, compact design. All principal parts (motor, pump, float switch, drain plug) in front — for easy service.



4200 Series CAST IRON TANK
Exactly the same design and performance as the 4100 series, except for cast iron tank where necessary or desirable.

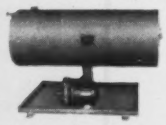
Sterlco®

low pressure condensate pumps

CAPACITIES: 2000 TO 15,000 SQ. FT. E.D.R.

Sterlco pumps are specially engineered . . . they are not adaptions of industrial or water supply pumps. Both series can deliver full rated output continuously, for long periods. Efficient impeller design prevents serious overloading of motors under any conditions.

SPECIAL APPLICATIONS — *For boiler return systems, greater capacities, or higher pressures, the 3500 series is available. It can be built to handle any job.*



Ask your plumbing and heating distributor, or write us for complete information!

Leaders since 1916 **Sterling inc.**
5202 W. Clinton Ave., Milw. 23, Wis.

RECENT TRADE LITERATURE
Continued

Insulated Piping Systems

Twenty page booklet presents design and installation data for prefabricated insulated piping systems. Information given on cost considerations, specifications, testing, and recommendations. Includes directions for calculating heat losses. Illustrated with tables and line drawings. — *Durant Insulated Pipe Co., P.O. Box 10500, Palo Alto, Calif.*

Hand Tools for Pipe and Tubing

Sixteen page catalog describes six basic cutter lines ranging from tubing cutters of ⅛ to 1⅛ in. capacity to rotary cutters for 10 to 30 in. iron or steel pipe. Also shows pipe and bolt threader sets; chain and yoke tripods; pipe and chain wrenches; and pipe vises. Technical data includes a cutter wheel reference chart and tables of solid and adjustable pipe and bolt dies. — *Reed Mfg. Co., Erie, Pa.*

Split-Body Control Valves

Sixteen page bulletin LB-4 gives details on construction and operation of single-seated units. Seat ring drops out when body halves are separated. A cutaway photo has names of parts listed. Illustrated with photos, line drawings, and tables. — *Conoflow Corp., 2100 Arch St., Philadephia 3, Pa.*

Rigid Polyvinyl Chloride

Twenty-three page catalog RV-61 explains PVC, PVC products, properties, chemical resistance, design and fabrication possibilities, and applications. Tables, line drawings, graphs, and photos present a variety of information. — *Kaykor Products Corp., Yardville, N. J.*

Babbitt
Adjustable
SPROCKET RIM
with Chain Guide
Changes that Danger Zone to a
SAFETY ZONE

—enables you to
ADD PLANT AREA

If re-aligning equipment will yield more working space, better production, lower costs—do it now. Save all space wasted for placing ladders to reach overhead valves. At the same time, convert Danger Zones to Safety Zones. Equip every overhead valve wheel in your plant with Babbitt Adjustable Sprocket Rims with Chain Guides.

- They simplify pipe layout.
- They fit any size valve wheel.
- They are easy to install and operate.
- They operate any valve from the floor.
- They save time and money.
- The first cost is the only cost (no maintenance).
- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

Babbitt Adjustable Sprocket Rims with Chain Guide are carried in stock by most mill supply houses. Just phone your mill supply salesman or contact us direct.

Babbitt 168-9
STEAM SPECIALTY CO.
8 BABBITT SQUARE, NEW BEDFORD, MASS., U.S.A.

RECENT TRADE LITERATURE

Continued

Ball Valves

Four page brochure describes units available in a combination of metals, seals, seats, and pipe ends. Five types of pipe ends are available: flanged, screw end, socket weld, butt weld, or welded-in-nipple. Illustrated with 13 photos, four line drawings, and five charts. Includes a cost comparison between a standard ball valve, a standard gate valve, and firm's ball valve. — *Worcester Valve Co., Inc., Worcester, Mass.*

Extruded Aluminum Diffuser

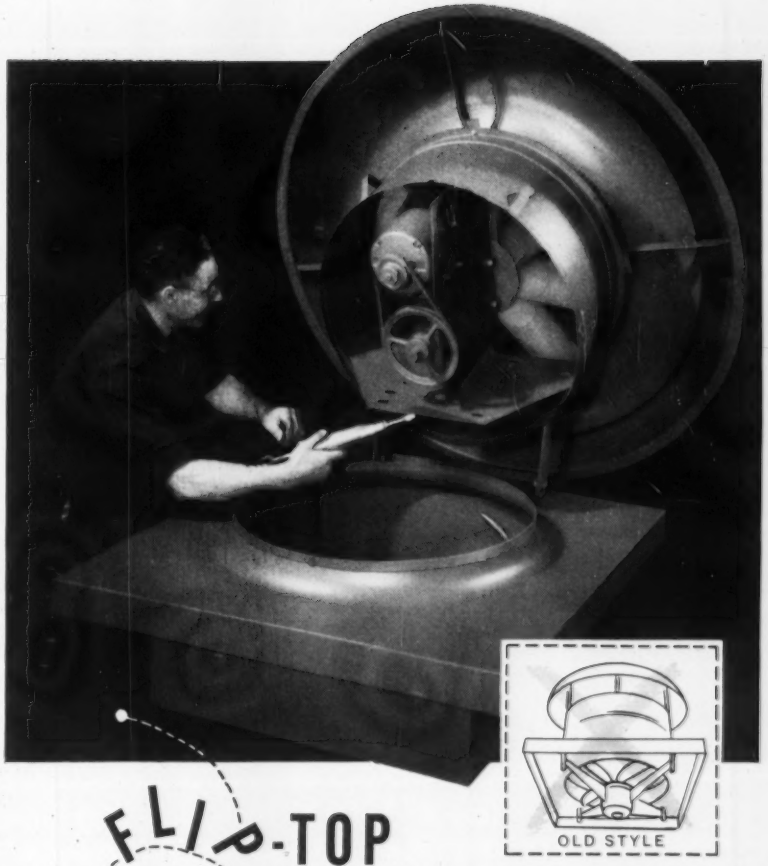
Twelve page catalog D-7-61 shows five frame styles and 14 core patterns of a type "D" directional diffuser. Available in square and rectangular designs which include one-way flow, two-way opposite flow, three-way flow, four-way flow, and two-way corner flow. Comes with snap-in, bevelled, drop collar, flange, and lay-on frames. Gives installation and selection data. — *Waterloo Register Co., Inc., P.O. Box 147, Waterloo, Ia.*

Circular Slide Rule

Pocket-size calculator for performing functions of multiplication, division, and proportions. Includes instructions. Make request on business letterhead. — *General Industrial Co., 1788J Montrose Ave., Chicago 13, Ill.*

Pump Fundamentals

Sixteen page booklet gives an elementary outline of the characteristics, operation, and selection of reciprocating, rotary, and centrifugal pumps. Report is non-technical. Includes definitions, basic formulae, examples, and other data used in pump application. — *Goulds Pumps, Inc., 226 Black Brook Rd., Seneca Falls, N.Y.*



FLIP-TOP
ROOF VENTILATOR
cuts Maintenance Cost

Entire motor-and-fan housing may be flipped back 90° to make motor, drive assembly and fan conveniently accessible above roof level. Such easy access to all working parts for quick inspection cuts maintenance costs substantially by saving time and making the work easier.

This new DeBothezat "flip-top" Power-Flow roof ventilator offers fan wheels from 12" to 48" in diameter and capacities to 43,070 CFM. A Vertical Discharge Model exhausts dust and oil-laden air at high velocity, to disperse contaminants high enough to prevent their re-entry into building's air supply.

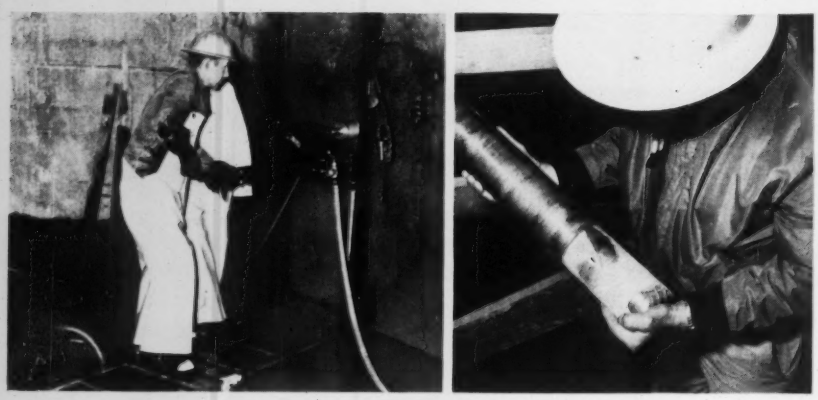
Write for illustrated Bulletin DR-7-61

De Bothezat®
DE BOTHEZAT FANS DIVISION OF
American Machine and Metals, Inc.
Dept. HPA-1061, EAST MOLINE, ILLINOIS

Divisions of American Machine and Metals, Inc.

TROY LAUNDRY MACHINERY • RIEHLE TESTING MACHINES • DE BOTHEZAT FANS • TOLHURST CENTRIFUGALS • FILTRATION ENGINEERS • FILTRATION FABRICS • NIAGARA FILTERS • UNITED STATES GAUGE • AUTOBAR • AUTOMATIC DEVICES • LAMB ELECTRIC COMPANY • HUNTER SPRING COMPANY • GLASER-STEERS CORPORATION

Who's the specialist in large steel heating boilers?
PACIFIC!
For nearly 50 years, Pacific has specialized in big boiler design . . . big boiler construction. Thousands of Pacific boilers have been successfully installed all over the world. With Pacific you get the largest line of low pressure steel heating boilers. The widest experience, too. Pacific men are boiler experts. There's a Pacific representative in your area. Call him for your next boiler.
PACIFIC STEEL BOILER DIVISION
Division of Crane Co., Johnstown, Pennsylvania
AT THE HEART OF HOME AND INDUSTRY
CRANE
VALVES AND PIPING • ELECTRONIC CONTROLS
PLUMBING • HEATING • AIR CONDITIONING


CUTTING POWER!
400 holes through 24-inch walls of concrete and heavy steel!
Longyear
To do a real tough job, a heavy construction firm with plenty of diamond drilling experience picked Longyear air-powered drills and 4-inch diamond bits. The rugged feed system and the powerful air motors helped finish the job on schedule. For more information on Longyear air driven and electric drills, write department 5C.
E. J. LONGYEAR CO.
76 S. Eighth Street, Minneapolis 2, Minnesota
Phone: FEderal 9-7631
Adv. 175C

RECENT TRADE LITERATURE

Continued

Indicating Controllers

Two page catalog sheet provides information on type "E36N" indicating temperature control. Series "900" has a range from 0 to 1000 F. Series "800" has a range from −150 to 650 F. Covers applications, construction features, and explains control ranges. — *United Electric Controls Co., 85 School St., Watertown 72, Mass.*

Shell-Type Motors

Four page bulletin 107 describes units available in open, enclosed, or liquid cooled ratings ranging from ½ to 150 hp. Cutaway photos show mechanical features. Electrical features are explained with graphs. Ventilation data are presented in table form. Illustrated with line drawings. — *The Louis Allis Co., Dept. P, 427 E. Stewart, Milwaukee, Wis.*

Couplings

Two bulletins (240-61 and 250-61) give information on connect-disconnect couplings. Type "E" is used in high pressure, gravity flow, and vacuum systems; type "H" is used primarily in hydraulic lines. Includes a complete cataloging of spare parts, accessories, and suggested applications. — *Snap-Tite, Inc., Union City, Pa.*

Surge Arrestor Valve

Sixteen page bulletin W-16 describes cushioned valve that anticipates the surge to protect the system. Controls of pilot automatically open main valve on overpressure, underpressure, or electrical power failure. Illustrated with photos, line drawings, and tables. — *Golden-Anderson Valve Specialty Co., 1210 Ridge Ave., Pittsburgh 33, Pa.*

RECENT TRADE LITERATURE

Continued

Temperature Regulators

Eight page catalog TCV-1 presents data on units available in self or pilot operated models from ¼ through 6 in. sizes. Shows cutaway pictures, lists nomenclature, ratings, dimensions, applications, operation, ranges, construction materials, specifications, flow curve, and sizing charts. — *OPW-Jordan, 6013 Wiehe Rd., Cincinnati 13, Ohio.*

Surface Dehumidifiers

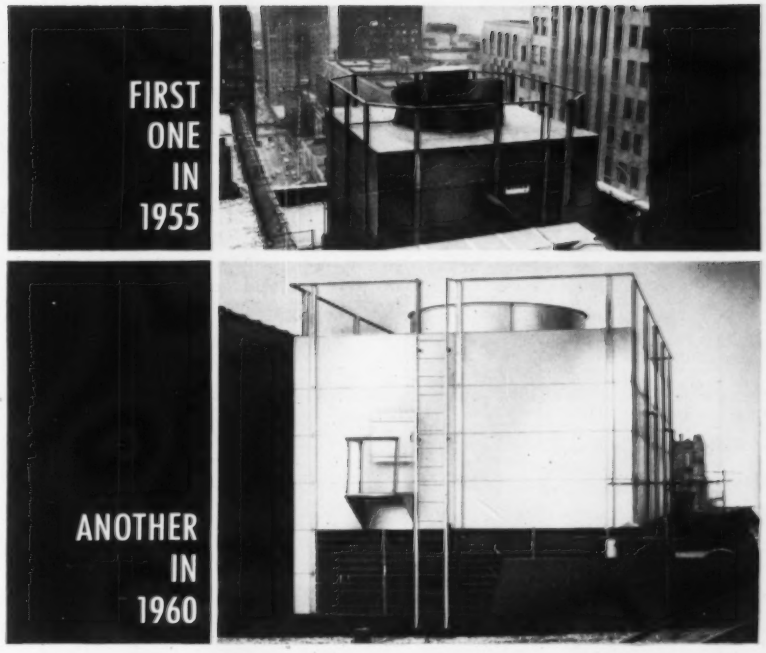
Eight page bulletin SCD-1 covers sectionalized spray coil surface dehumidifiers in sizes to 50,000 cfm. Requires only bolting together of sections for assembly. Includes construction details, component descriptions, weights, and dimensions. Illustrated with photos, line drawings, and tables. — *Blazer Corp., 173 Market St., Passaic, N. J.*

Descaling Boilers Chemically

Three page bulletin No. 40B tells how to descale power boilers chemically. Features a technical description of selected chemical materials used successfully in boiler descaling operations and an outline of a recommended descaling procedure complete with safety precautions. — *Oakite Products, Inc., 151B Rector St., New York 6, N.Y.*

Glass Fiber Reinforced Pipe

Two bulletins describe centrifugally cast, thermoset epoxy resin, glass reinforced pipe for handling special pressure and corrosion flows. A 12 page booklet describes product, applications, and physical properties. A 16 page booklet provides technical and specification data in detail. Includes tables of chemical resistance and various charts. — *Fibercast Co., P.O. Box 727, Sand Springs (Tulsa), Okla.*



The LaSalle Hotel, Chicago...

Saves $486.80 per day with Binks cooling towers!

"Without our Binks cooling towers our water bill would run $500 a day. As it is we pay only $13.20 per day for 86,000 gallons of makeup water . . . a savings of $486.80," reports Mr. J. E. Petermann, chief engineer of the LaSalle Hotel.

This 1000-room hotel now has two Binks 2-K cooling towers, one 2-fan unit installed in 1960 and a separate 1-fan tower which has been operating since 1955.

The new 2-K tower replaced a smaller Binks unit which had been in use for 23 years and was still operating perfectly when dismantled to make room for the new tower.

Two factors influenced the choice of another Binks tower . . . outstanding performance of the first two units and lower first cost of the new tower. Because Binks equipment is of modular design it is highly flexible. Expensive custom work or modifications were not necessary.

Free Specification Data

In 9 cases out of 10 a standard Binks cooling tower will meet your requirements exactly at a substantial saving. Write for mechanical and performance specifications.

0853

Binks

EVERYTHING FOR WATER COOLING

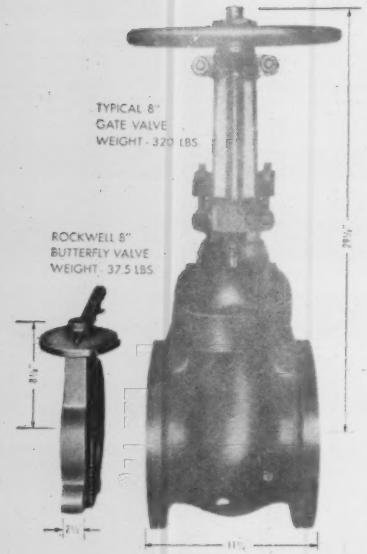
A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company

3144-A Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED DIRECTORY

Compare them
✓ for Weight
✓ for Space

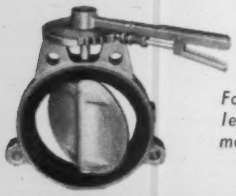


This Rockwell resilient-seated wafer butterfly valve and the large gate valve are both 8" pipe size. Both do the same job. But what a difference in weight, space—and cost.

What does this mean? It means a 60 to 80 per cent reduction in weight in favor of the butterfly valve, depending on size.

As for space, the 8" butterfly valve requires but 8⅜" from center line of pipe for clearance, whereas the gate valve requires over 37" from center line for clearance, when the valve is open.

There are other advantages, too: A quarter turn opens and closes the butterfly valve. The gate valve, however, requires many turns. And operation is easier; maintenance is lower.



Fact-packed Bulletin 590X tells more. Write for it.

W. S. ROCKWELL COMPANY
2700 Eliot St. • Fairfield, Conn.
Made and sold in Europe by
COCKBURNS, Ltd., Glasgow S.W.2, Scotland

RECENT TRADE LITERATURE
Continued

Automatic Pipe Turner

Two page data sheet describes unit that continually rotates pipe for cutting and welding tubular elements. Three-jaw chuck holds pipe firmly and eliminates end drift. Electric motor and gear arrangement assures constant speed. One model includes a double-end cutting assembly. Oxyacetylene torches are solenoid controlled for constant flame temperature. Welding is achieved with addition of an attachment. Illustrated with photos, a line drawing and tables. — *Steffan Mfg. Corp.*, 1585 *S. Lincoln Ave., Salem, Ohio.*

Damper Hardware

Four page folder gives data on damper hardware for all air conditioning systems. Shows complete installation and a chart for sizing damper blade depths before blades are formed. Illustrated with photos and tables. — *Young Regulator Co.*, 20910 *Miles Parkway, Cleveland* 28, *Ohio.*

Motel Heating and Cooling

A 17 by 21 in. folder explains firm's method of heating and cooling motels. System uses zoned hydronic baseboard heating and zoned water chilled valance cooling with individual room temperature control. — *Edwards Engineering Corp., Pompton Plains, N.J.*

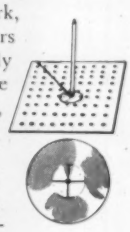
Marine Insulation

Four page bulletin F107 describes thermal and acoustical glass fiber insulation for marine applications. Contains data on three types of "NAV-hull Board:" thermal plain, thermal faced, and perforated acoustical. Discusses installation methods and gives types and sizes in chart form. — *Fibrous Glass Products, Inc., Alpa Plaza, Hicksville, N. Y.*

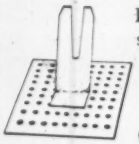
SAVE TIME— SAVE MONEY
with these dependable INSULATION HANGERS

GEMCO Spindle Hangers and W-A Self-Locking Washers

Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed... with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.



GEMCO Pronged Hangers



Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1 3/16" to 6⅞") bend over to hold insulation firmly in place.

TUFF-WELD Nylon Hangers

Two-piece hangers... with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and Improved General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 28, ILLINOIS

RECENT TRADE LITERATURE

Continued

Relief-Unloading Valve

Four page bulletin S-5 describes automatic unit for steam, air, gas, and fluid control service. Furnished in sizes from 2½ to 24 in. with flanged ends for service to 900 psi. Complete selection data and engineering specifications are included. — *Golden-Anderson Valve Specialty Co., 1210 Ridge Ave., Pittsburgh 33, Pa.*

Materials Flow Control

Eight page bulletin No. 4.20-1 describes meters, feeders, and controls for controlled feeding of liquids and solids in process industry systems. Illustrated with photos and line drawings. — *B-I-F Industries, Div. of the New York Air Brake Co., Providence, R.I.*

Sound Measuring Equipment

Catalog features line of sound measuring and analyzing instruments, industrial amplifiers, speakers, and FM turners. Also contains information on multiplex adaptor and test equipment. — *H. H. Scott, Inc., Instrument Div., 111 Powder Rd., Maynard, Mass.*

Pneumatic Current Controller

Two page data sheet 104 describes pneumatic-electric transducer affording automatic regulation of current, voltage, resistance, inductance, and capacitance. Consists of a positioning cylinder actuator, a rack and pinion arrangement, coupling, mounting plate, and electrical component such as a rheostat, autotransformer, or potentiometer. Cylinder receives a standard instrument air signal and produces a proportional rotary motion (up to 360 deg) which positions the electrical device. Lists typical applications, specifications, and dimensions. — *Conoflow Corp., Arch St., Philadelphia 3, Pa.*

SAVE SPACE and REDUCE COSTS

with

AURORA®

VERTICAL END-SUCTION PUMPS

Capacities to 1800 GPM.
Heads to 320 Feet

This close-couple, vertical mounting design provides the extreme compactness that is so important for the many applications where space allocation is critical. Flanged suction mounting cuts piping costs by direct mounting to tank. Separate foundation arrangement is eliminated along with any alignment problems. Optional discharge arrangement permits the most simplified installation.

The many desirable features of the Horizontal End Suction Pumps are retained . . . motor and rotary assembly easily removable without disturbing the suction or discharge piping . . . low NPSH . . . smooth quiet operation. Available in vertical base mounting design as well as close coupled or flexible coupled horizontal models.

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THE NEW YORK AIR BRAKE COMPANY
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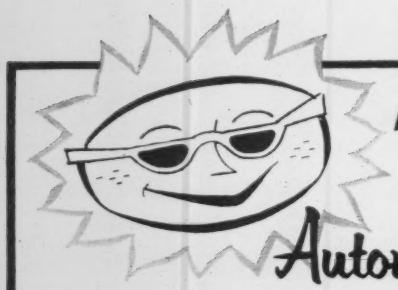


Rely on dependable

BASMOR

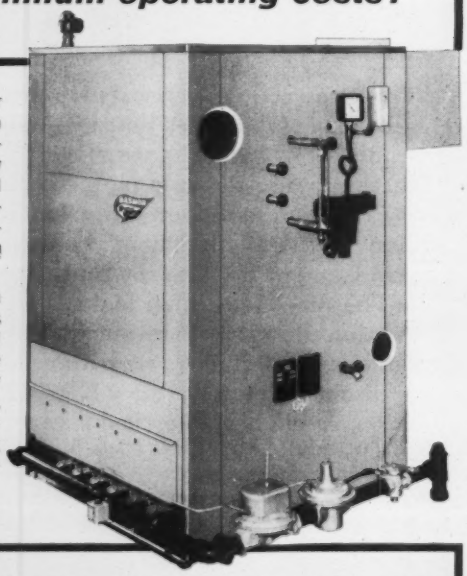
Automatic Sunshine

to meet big heating demands!

AUTOMATIC SUNSHINE is radiant hydronic heating with a Basmor Boiler. The healthful even, sun-like warmth of heat by radiation, whether from radiant baseboard, panels, convectors or conventional radiators.

Basmor Gas-Fired Boilers in sizes to meet commercial, institutional and industrial heating demands efficiently and economically. For all steam, hot water or vapor systems, and large volume water heating by the indirect method.

engineered for fast installation, simplified servicing, minimum operating costs!



Basmor 400 Series (Water Boiler shown above) in ten sizes from 375,000 to 1,050,000 BTU input. Top combustion efficiency with cast drill port burners and finest controls. Maximum utilization through patented "staggered heat travel" cast iron section design.

Basmor 600 Series (Steam Boiler at right) in thirty-six sizes from 725,000 to 5,800,000 BTU input, permits "tailored-to-the job" selection to accurately meet heating requirements. Yes, you can rely on Basmor Automatic Sunshine for big heating demands! Write for complete information.

Basmor -- Little

BASTIAN-MORLEY CO., INC.

(Incorporating H. C. Little Burner Co., Inc.)

LaPorte, Indiana

Basmor-Little Boilers, Furnaces, Gas Heaters, Water Heaters, Incinerators

RECENT TRADE LITERATURE

Continued

Pump Seal Replacement

Eight page bulletin M 101-7 outlines mechanical seal replacement for end mounted sealed and packed industrial pumps. Specifies tools to be used; complete disassembly and reassembly instructions, cleaning and inspection hints, and general information. Illustrated with a photo of cutaway pump, line drawing, and exploded view of pump head. — *Roy E. Roth Co., Turbine Pump Div., Rock Island, Ill.*

Split-Case Centrifugal Pumps

Eight page bulletin 105C gives data on single stage, double suction, horizontal split case pumps. Suction and discharge connections are in bottom half of case. Can remove rotating element without disturbing piping. Balanced impellers are keyed and screw locked in position. Capacities range up to 6000 gpm with heads to 380 ft. Contains sectional photos and selection charts. — *Aurora Pump Div., The New York Air Brake Co., Aurora, Ill.*

Propeller Air Movers

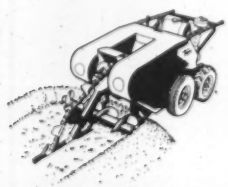
Eight page brochure describes a belted unit, direct drive unit, and an economy unit. Includes construction features, dimensional data, electrical characteristics, and performance charts. Accessories are illustrated. — *Greenheck Fan & Ventilator Corp., Schofield, Wis.*

High Heat Aluminum Paints

Two bulletins, HR-1206 and 1785 describes paints that withstand temperatures up to 1700 F. Suitable for either interior or exterior use and can be applied by brush, spray, or dip methods. Does not require baking. Dries hard in 6 hr. — *Speco, Inc.*, 7308 *Associate Ave., Cleveland 9, Ohio.*

THE TRENCHER ON THE MOVE!

AUBURN...
'Compact' moves to any job faster and easier . . . its retractable tow bar and hydraulic transport gear eliminate trailers or loading. The 'Compact' superior design and quality construction allow you to cut more trench per day at less cost . . .



'COMPACT' Quality Features..

- Rugged Single Unit Body
- Variable Speed Hydraulic Drive
- Reversible Four Wheel Drive
- Retractable Transport Wheels
- Hydraulic Boom Lift
- Patented Digging Bits
- Cuts Clean Straight Trenches
- Trouble Free Dirt Disposal

Write for **FREE** *Brochure*

AUBURN MACHINE WORKS, INC.
2145 South J Street
Auburn, Nebraska, U.S.A.
Phone BRidge 4-3141

RECENT TRADE LITERATURE

Continued

Polyphase Squirrel Cage Motors

Two page bulletin 500 describes integral units, rated at 1 through 5 hp. Includes general purpose and special purpose, open drip-proof motors. Available with a variety of mountings, electrical and mechanical modifications, and all standard voltages, frequencies, and speeds. Contains typical performance curves and NEMA frame assignments by hp and speeds. — *The Leland Ohio Electric Co.*, 1501 *Webster St.*, *Dayton* 1, *Ohio.*

Pipe Bending Equipment

Eight page bulletin IM-720 gives data on hydraulic conduit and pipe benders. Tells how to make various types of bends. Eight page bulletin E-301 describes a pipe bending degree indicator. Two page bulletin E-317 explains pipe holders used as accessories in bending operations. — *Greenlee Tool Co.*, *Rockford*, *Ill.*

Air Conditioning Equipment

Forty page catalog features blower units, fans, coils, cooling towers, evaporative condensers, valves, fittings, etc. New equipment includes air cooled and evaporative condensers in capacities to 100 tons and a line of blow through cooling towers to 1000 tons, utilizing a high efficiency airfoil type axial fan. Illustrated with photos, line drawings, tables, and charts. — *Blazer Corp.*, 173 *Market St.*, *Passaic*, *N.J.*

Interception Air Filter

Two page bulletin 171 presents design and performance data on disposable unit. Efficiencies from 45 to 95 percent, depending on filter medium used. Illustrated with photos, a table, and pressure drop curve. — *Cambridge Filter Products Corp.*, 738 *E. Erie Blvd.*, *Syracuse* 1, *N.Y.*

SC **Cut Idle Time This Winter**

• • •

DON'T HOLD UP LAGGING JOBS FOR HIGHER TEMPERATURES

• • •

Use CLAIR COAT
Lagging Adhesive for FAST LAGGING even in a damp 40° F.

And if CLAIR COAT should freeze solid — it still is usable.

Other CLAIR COAT Advantages:

FAST SETTING — sets almost immediately

NONFLAMMABLE — fire retardant film

STRONGEST PERMANENT BOND—by comparative tests

STEAM PROOF — WATER PROOF — VERMIN PROOF NON - TOXIC

ONE COAT NEEDED — fine appearance — long lasting — easily washable

***Also*-NEW** ST CLAIR LAP SEALING ADHESIVE **#45007**

MANY IMPORTANT ADVANTAGES— write for prices — samples of either or both adhesives

ST. CLAIR RUBBER CO.
Empire Bldg.
107 Clifford St. Detroit 26, Mich.

RECENT TRADE LITERATURE

Continued

Transistorized Sound Meter

Two page bulletin K 18 C gives data on hand-held type "B" transistorized sound survey meter. Weighs 1 lb including battery. Frequency response within A.S.A. specified tolerances in the 45 to 8000 c.p.s. noise spectrum. Has ability to measure relative magnitudes of vibration or structure-borne noise by means of a mating transducer which plugs into the meter. — *The Korfund Co., Inc., Acoustics & Instruments Div., OIF Cantiague Rd., Westbury, L.I., N.Y.*

Automatic Heating Controls

Ninety-eight page catalog No. 608.426 is a condensed listing of firm's entire line of heating controls. Includes information on new "Sheer Line" room thermostats with fixed or adjustable heat anticipation; mercury switch, snap-action or thermo-poised contacts; 24 v, millivolt, or line voltage models. Also includes "Midgitrol" gas valves with interchangeable operators mounted on a single integral body. Illustrated with photos and tables. — *General Controls Co., 801 Allen Ave., Glendale 1, Calif.*

Differential Pressure Gage

Two page bulletin E10 gives data on a leak-proof model operating by a magnetic coupling. Designed for indicating up to 60 psid in systems up to 3000 psi. Contains specifications and drawings. — *Pall Corp., Glen Cove, N.Y.*

Compression Tube Fittings

Twenty page catalog 4323 presents data on 25 items of tube fitting line. "Ridg-lok" features reversible ferrule; both ends are identical so there is no danger of installing backwards. Made in Type 316 stainless steel for corrosion resistance and in brass for instrumentation, air, oil, water, and coolant lines. Size range for tubing from 1/16 through 1 in. OD. Illustrated with photos, line drawings, and tables. — *Parker-Hannifin Corp., Parker Fittings & Hose Div., 17325 Euclid Ave., Cleveland 12, Ohio.*

Two-Stage Centrifugal Pumps

Eight page bulletin 722.6 describes units available in sizes 6 by 8 by 17 in. and 8 by 10 by 17 in. Provide capacities up to 3000 gpm for heads to 550 ft at 1750 rpm. Includes performance curves, material specifications, interchangeability charts, and dimensions. — *Goulds Pumps, Inc., 227 Black Brook Rd., Seneca Falls, N. Y.*

Stainless Steel Condenser Tubing

Twelve page booklet gives detailed information on the use of stainless steel tubing in condensers. Includes historical background, performance data, applications in various types of water, fabrication of tubes, and other information. Also includes photos and charts. — *Allegheny Ludlum Steel Corp., Oliver Building, Pittsburgh 22, Pa.*

Relief Valves

Two eight page brochures available: one features combination temperature and pressure relief valves (F-TP); the other features ASME-rated pressure-only relief valves (F-ASME-1961). Both include installation diagrams and complete rating tables. — *Watts Regulator Co., Lawrence, Mass.*

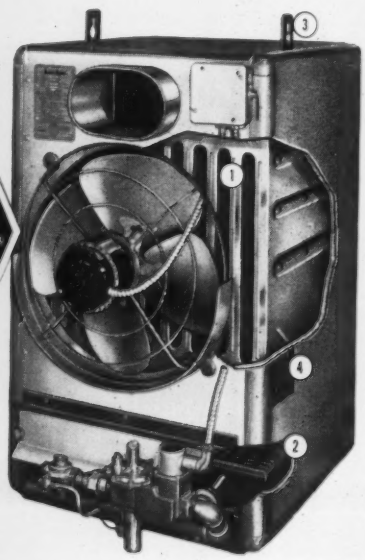
Atmospheric Air Torches

Four page bulletin describes units for use with both acetylene and propane, along with regulators, tips, and accessories for heating, soldering, and light brazing. Illustrated with photos and line drawings. — *Acetylene Supply Co., Woodbridge, N.J.*

inside story of quality

Mueller Climatrol
DIVISION OF WORTHINGTON

SUSPENDED GAS UNIT HEATER



1. **RESISTAL*** aluminized steel heat exchanger resists corrosion many times longer than ordinary steel. Designed for maximum heat transfer with no direct flame impingement. All-welded construction for quiet operation, long, trouble-free life.
2. Cast-iron drilled-port burners for "clean", service-free operation.
3. Convenient triple-duty lifting and hanging brackets.
4. Automatic fan and limit control plus summer switch.

Complete size range from 25,000 to 225,000 BTU output. AGA and CGA approved for all gases. Shipped assembled, pre-wired, and test-fired.

Write for details today!

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2000 West Oklahoma Ave., Milwaukee, Wis.
1024 Westminster Ave., Alhambra, Calif.

*TM

MC-99

All New
Webster
DUAL FUEL
CYCLONETIC*
Burner

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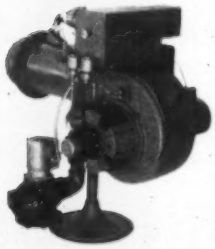
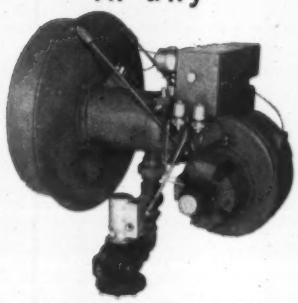


in any



Configuration

* TRADE MARK

Write for Literature

WEBSTER ENGINEERING
TULSA 9, OKLAHOMA
MR
a division of
Midland-Ross Corporation

RECENT TRADE LITERATURE

Continued

Dust Control

Twenty page bulletin 922A describes various methods for controlling industrial dust and fumes. Gives a short non-technical explanation of the advantages available through proper dust control, and lists the basic essentials comprising a typical dust control system. Explains collectors, illustrating them with line drawings and photos. — *Pangborn Corp., Hagerstown, Md.*

Welding Safety Equipment

Twenty page catalog N-177 presents data on helmets, hand shields, goggles, safety glasses, safety hats and caps, face shields, portable screens, gloves and mittens, and accessories. — *Manufactured by the Safety Products Div., American Optical Co.; distributed by the NCG Div., Chemetron Corp., 840 N. Michigan Ave., Chicago 11, Ill.*

Heat Exchangers

Twenty-six page bulletin No. 356 describes "Panelcoil," a heat exchanger made from two metal sheets welded together with flow channels inside, permitting steam, water, oil, refrigerant, etc. to flow in series, parallel, or series-parallel. Includes various charts and tabulations, including an LMTD chart. Tells how to figure heating load, how to select heating surface, and similar information. — *Dean Products, Inc., 1042 Dean St., Brooklyn 38, Ill.*

Variable Speed Belts

Twenty page bulletin 24013 gives five tables presenting data on variable speed belt replacement. Compares part numbers of manufacturers of equipment using variable speed belts, manufacturers of the belts, and its own firm. — *T. B. Wood's Sons Co., Chambersburg, Pa.*

HOW TO SAVE COOLING DOLLARS and BEAT COMPETITION

with FANJET roof cooling

10 Degrees Cooling

Combine with air conditioning systems for real benefits. Special division for architects & air conditioning companies.

Heat Gain — Savings — Cost Estimates and Proposals in 48 Hours

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☐ Please contact me
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Street .....

City ..... State .....

Name .....

(Mail Coupon for Prompt Reply)

WE HEAR THAT . . .

REX E. HIERONYMUS has relinquished his position as general superintendent of buildings for *ALDIS & CO., INC.*, and will be succeeded by Vincent C. Joncas. Mr. Hieronymus, a consulting and contributing editor for Heating, Piping & Air Conditioning, will retain his positions at Aldis of vice president and secretary of the corporation, and an engineering partner of the firm.

OLIN MATHIESON CHEMICAL CORP. has begun a multi-million dollar expansion program at its Omal, Ohio, aluminum rolling mill. New facilities to be added at Omal will include a 36,000 sq ft building, a 66 in. cold-rolling mill for producing bright-finished sheet, and related equipment. Completion is expected by the end of 1962. Olin has also planned to construct a new brass and copper casting and rolling plant at East Alton, Ill., and modernize other brass facilities.

MULTI-AMP ELECTRONIC CORP. has moved into a 15,400 sq ft building at 61 Myrtle St., Cranford, N.J. The firm was previously located in Union, N.J. The building is a single story structure on a two acre tract.

THE FAIRBANKS CO. will be moving its Boston, Mass. office and warehouse to a new building located at 767-A Concord Ave., Cambridge 38, Mass.

ROBERTSHAW-FULTON CONTROLS CO. is building new executive offices in suburban Richmond, Va. Construction is scheduled for completion in the summer of 1962.

GABE M. MARIN has been elected vice chairman of the board and of the executive committee of the *NATIONAL OIL FUEL INSTITUTE*. Mr. Marin is president of Sun-Ray Burner Mfg. Corp.

ARMCO STEEL CORP. has begun production with its new 72 in. continuous zinc-coating line. The $8,500,000 line has a process capacity of 30 tons per hr, and is in operation 24 hr a day.

Negotiations have been completed to make *B-I-F INDUSTRIES* a division of *THE NEW YORK AIR BRAKE CO.* B-I-F continues its operations in Providence, R.I. under the same operating management and with no change in aims or objectives.

Tired of residential heating bids with pennies of profit?

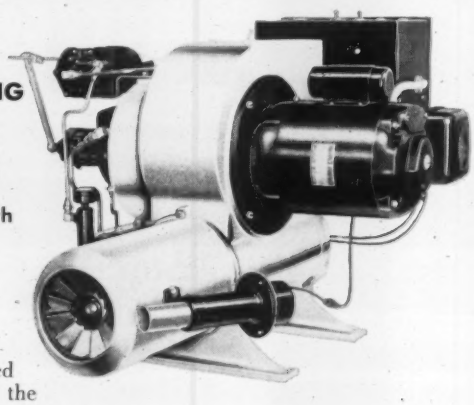
NOW LOOK TO MONEY-MAKING COMMERCIAL JOBS with

HEV-E-OIL BURNERS

Simple as residential installations — with FULL PROFIT and LESS COMPETITION

Home building off, profits down? This year plan to diversify and get part of the huge apartment, commercial and industrial market. HEV-E-OIL Burners are designed to burn inexpensive, heavy oils with all the know-how built in at the factory. This precision engineered unit can be your best salesman.

Each unit is a complete package, ready and as easy to install as any home burner. HEV-E-OIL Burners are factory assembled, fire tested, completely wired. Automatic electronic controls are connected, tested and mounted on the burner. Simple, fast installation saves dollars in time and labor — gives you the FULL PROFIT you deserve . . . with far less competition!



- **Complete range of sizes: 5 to 150 gph.**
- **Only commercial burner to apply the principle of low pressure air atomization of heavy oils *inside the burner nozzle.***
- **All combustion air furnished by the burner.**
- **Meets all code standards; Underwriters' Laboratory approved.**
- **Sold and serviced throughout the world.**

Be the first to get this Plus Profit business in your market. Write Dept. E-101 for complete details and a nation-wide listing of HEV-E-OIL installations. It will give you an idea of where to prospect for Bigger Profits this year.

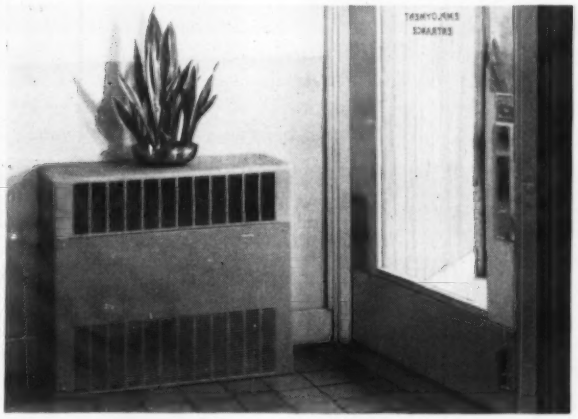
Dept. E-101

INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4447 N. OAKLAND AVE., MILWAUKEE 11, WIS.

CARRIER CABINET UNIT HEATERS

...versatile in application, economical in operation and handsomely styled!



For new construction or modernization, there's a cabinet style and size in this Carrier line to meet your needs for almost any heating job. They're available in free-standing, variable semi-recessed and recessed models for floor, wall or ceiling mounting. Sizes range from 20,800 to 117,000 Btuh, and there are twenty-one coil-cabinet arrangements for either steam or hot water systems. Advantages? Many; among them:

- All connections may be made within cabinet — no piping need be exposed.
- Low fan speed keeps noise level low — yet, where needed, high fan speed can deliver large volumes of air to hard-to-heat corners.
- High-capacity coils with non-ferrous fins and tubes provide maximum heat transfer and long life.
- Totally enclosed, permanently lubricated motor.
- Whole assembly can be removed if an inspection or fan cleaning is required.

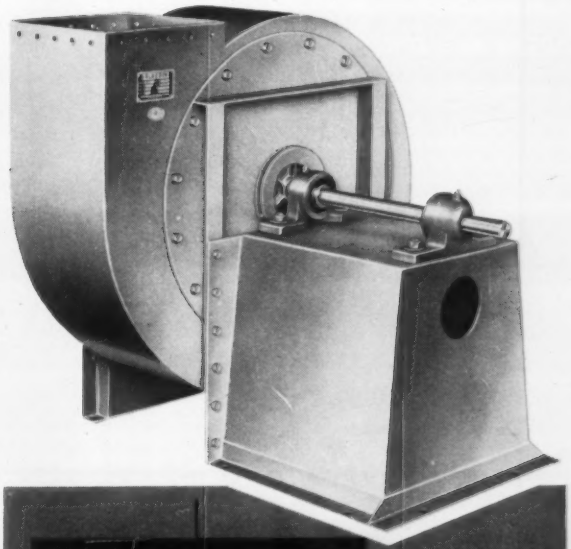
Carrier offers every type of equipment for any industrial or commercial job: Heating and Ventilating Units for steam and hot water; Unit Heaters for steam and hot water; Gas-fired Unit Heaters and Duct-furnaces. For complete information, call your Carrier representative listed in your Classified Telephone Directory under "Heaters—Unit." Or write Carrier Air Conditioning Company, Syracuse 1, New York.

Carrier

Air Conditioning Company

Aladdin

AIR HANDLING EQUIPMENT



TYPE "EX" INDUSTRIAL EXHAUSTER

- **RUGGED**
- **EFFICIENT**
- **DEPENDABLE**

ALADDIN Industrial Exhaust Fans are all-welded steel plate construction. They are ideal for material handling such as conveying grains, shavings and sawdust, or for dust removal from grinding of buffing wheels. The EX fan is also the first choice for many jobs where fumes, hot air or gasses must be handled by a rugged, efficient, dependable fan.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

WE HEAR THAT

Continued

WILLIAM R. STOCKWELL, 86, died recently in New York, N.Y. Mr. Stockwell was a former vice president and general manager of *WEIL-MCLAIN CO.* He was one of the organizers of the Institute of Boiler & Radiator Manufacturers, later serving as chairman and director, and was an honorary lifetime member of the American Society of Heating, Refrigerating & Air-Conditioning Engineers.

ANEMOSTAT CORP. OF AMERICA has moved all production and research facilities to a single-level, 165,000 sq ft plant in Scranton, Pa. The address is 388 N. Keyser Ave., Scranton, Pa. The general sales offices will remain in New York, but will move to 25 W. 43rd St., New York 36, N.Y.

PLASTILINE, INC. has opened a midwest warehouse located at 140 Walnut St., Kansas City, Mo.

HART & COOLEY MFG. CO. OF CANADA LTD. has been licensed to manufacture and distribute all products of the *ELGIN MFG. CORP.* of New York.

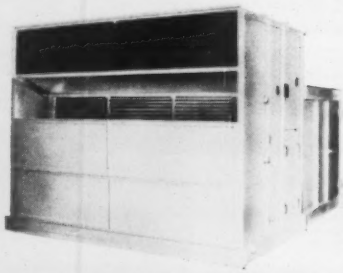
CHICAGO HEATER CO. has opened new engineering and administrative offices at 273 Fifth Ave., New York, N.Y.

THE TRANE CO. is building a $700,000 addition to its Engineering Building in La Crosse, Wis. The 31,500 sq ft of additional space will be acquired by adding a second floor to the structure. Completion is scheduled for early 1962.

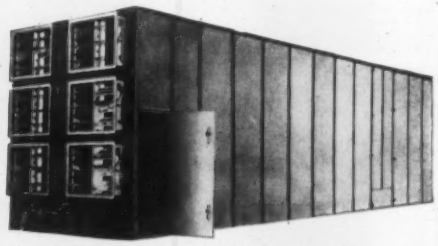
PENN CONTROLS, INC. has acquired the assets of *BASO, INC.* and its operating subsidiary, *VULTEL, INC.*, subject to the approval of the stockholders of Baso. Baso and Vultel will become a division of Penn.

JAMESBURY CORP. and Serck Ltd. have formed *JAMESBURY-SERCK LTD.* in Gloucester, England to manufacturer and market the Jamesbury "Double-Seal" ball valve and related products.

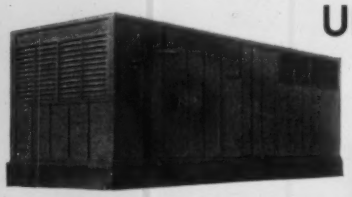
The Japanese government has approved payments of royalties to *HYDROMETALS CO.* by Nippon Soda Co., Ltd. for production of "Hydro-T-Metal," a titanium-copper-zinc alloy. Such approval is required in Japan.



DOUBLE DUCT UNITS



MULTIPLE ZONE UNITS



ARTICULATED AIR CONDITIONING UNITS

AIR CONDITIONING EQUIPMENT

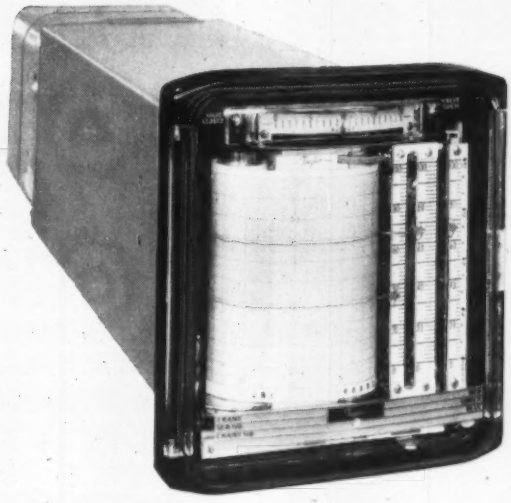
AIR & REFRIGERATION CORPORATION

439 MADISON AVE. • NEW YORK 22, N. Y.

SALES REPRESENTATIVES IN PRINCIPAL CITIES

A&R

EXCEPTIONAL CONVENIENCE



No other recorder, regardless of size, puts so many features in so little panel space

The Taylor TRANSCOPE® Recorder (90J) is now generally recognized as the most modern, most convenient and most accurate instrument for recording process variables at a central point.

Servo-operated Pens assure unprecedented accuracy of records.

Front of Panel Control Settings let you make adjustments easier, quicker and better . . . *from the front of panel* . . . while recording!

Stays on Automatic Control while the plug-in recorder slide is removed for inspection, yet providing continuous fully automatic control.

Complete Indicating Control Station while recorder is removed. Horizontal gage at top of recorder will show either process variable or air output to valve, as desired.

Receives Three Variables to be recorded or indicated; has a Set Point Transmitter; Process Alarms with Memory Pointers; an Automatic-to-Manual switching lever; a cascade or Process-output Indicator, and many other features . . . all in a compact case.

See your Taylor Field Engineer, or write for **Catalog 98286.** Taylor Instrument Companies, Rochester 1, N. Y., or Toronto, Ontario.

Taylor Instruments
MEAN ACCURACY FIRST

NEW! AUTOMATIC SELF CLEANING
LINT-A-MAZE ARRESTOR

Cleans the air of...

*** LINT**
*** CHAFF**
*** FIBROUS MATERIAL**

AIR-MAZE LINT-A-MAZE FILTERS are specially designed to provide 98% or more efficiency in removing heavy concentrations of lint, chaff, leather cuttings and similar materials from the air. Brushes mounted on a chain carrier continually sweep and automatically clean the collector screens. Collected material is deposited in a hopper for reprocessing or sale. Lint-A-Maze filters offer these important advantages:

- Low initial cost . . . low operating cost
- Require less than 50% of the space normally needed
- Virtually eliminate maintenance – no rolls or blankets to replace, no washing or cleaning
- Handle wet or dry impurities
- Can be installed in any recirculating air opening, ventilating or air-conditioning system
- Available for airflow requirements from 7,000 to 150,000 CFM, can handle air velocities from 250 to 1900 FPM.

AFI MEMBER

FREE! For additional information write for Bulletin No. 150.

AIR-MAZE DIVISION
CLEVELAND 28, OHIO

ROCKWELL R STANDARD

ROCKWELL-STANDARD CORPORATION

WE HEAR THAT

Continued

The former Reinforced Plastics Div. of the *A. O. SMITH CORP.* has changed its name to the *GLASS FIBER PRODUCTS DIV.* The company is located in Milwaukee, Wis.

A merger agreement between *SERVISOFT, INC.*, a wholly owned subsidiary of the George Getz Corp., Chicago, Ill., and *STER-O-MATIC, INC.* of Mundelein, Ill. has been made by the two firms. The new corporation formed will be the *WATER TREATMENT CORP.*

ENGINEERS JOINT COUNCIL has moved into its new headquarters in the new United Engineering Center at 345 E. 47th St., New York 17, N.Y.

LEWIS S. GOODFRIEND AND ASSOCIATES has moved into new offices and laboratories located at 48 Notch Rd., Little Falls, N.J. The firm now has expanded facilities for current research projects on the testing of vibration-isolation materials.

A new sound slide-film showing how gas air conditioning can be used economically and beneficially by schools is now available from the *AMERICAN GAS ASSOCIATION*. The 15-minute color strip is titled "A New Climate For Education," and is designed for sales presentations by gas companies to school boards, civic groups, engineers, and architects. More information can be acquired from AGA at 420 Lexington Ave., New York 17, N.Y.

Installation of complete custom facilities for the spray application of "plastisol" coatings to a wide variety of large industrial tanks and equipment has been made by the *G-N EQUIPMENT CO.*, 761 Wealthy, S.W., Grand Rapids, Mich.

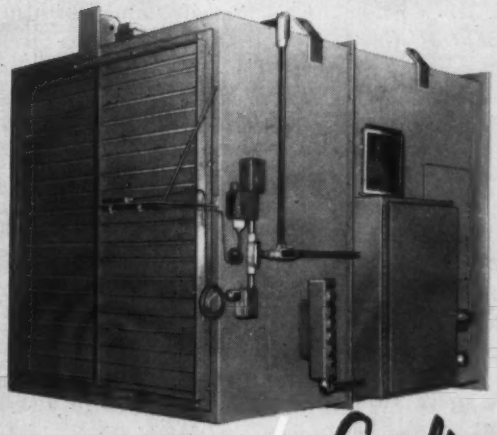
SMITH-BLAIR INC. has opened a new manufacturing plant in Texarkana, Tex. The plant has 22,000 sq ft of floor space.

VAPOR CORP. is the new name of Vapor Heating Corp. chosen by the company's directors. The title was selected to better reflect the diversified operations of the company.

MANUFACTURED BY
TJERNLUND
ADAPTABLE TO ALL COMMERCIAL HEATING NEEDS
YOUR GUARANTEE OF CUSTOM BUILT QUALITY
because Tjernlund heating equipment is
Manufactured 100% by TJERNLUND
HEAT EXCHANGER
Multiple flue arrangements for maximum heating surface in minimum space.
BLOWER ASSEMBLY
Custom designed and built for greater efficiency and quiet operation.
BURNERS GAS AND OIL
Precision built in full range of sizes. Also combination gas and oil.
AUTO-DRAFT INDUCERS
ALL-PURPOSE MODELS
FOR IMPROVING EFFICIENCY OF OLD AND NEW HEATING SYSTEMS
Exclusive Tjernlund design in full range of sizes. Simple installation and efficient venturi type operation.
Write For Literature
TJERNLUND MANUFACTURING CO.
2126 KASOTA AVENUE • ST. PAUL 8, MINNESOTA

two of a kind...

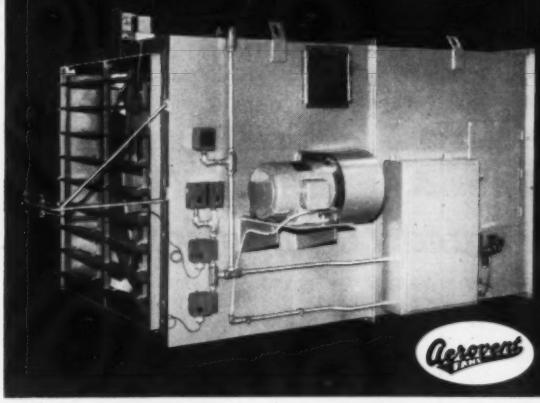
for all in-plant requirements



direct-connected **belt-driven**

Gas-fired

air make-up units



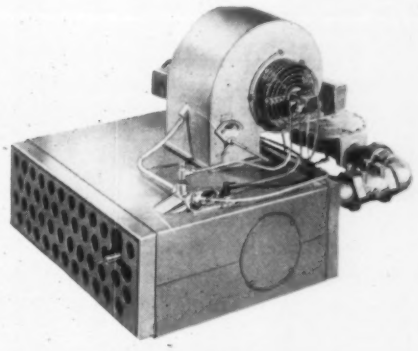
Let the breezes blow! You can maintain uniform temperatures and derive maximum efficiency from heating and ventilating systems *this* winter with Aerovent Gas-Fired Air Make-Up Units. And, you will be ready for next summer's heat, too, since each unit also serves as a filtered air supply unit. Why not investigate, today?

Standard models for all structures and all requirements in sizes 27″ through 60″ for capacities to 50,000 CFM and BTU/hr ratings to 4,875,000. Other units to specifications for capacities to 100,000 CFM and heat releases to 10,000,000 BTU/hr. Write for details and application data included with new Bulletin 860.

Air deliveries of all Aerovent equipment are tested and rated in accordance with established and accepted codes and each unit is guaranteed by the manufacturer to deliver its rated performance. CERTIFIED PERFORMANCE

Aerovent FAN COMPANY, INC.

ASH and BRANCH STS. PIQUA, OHIO



SAVES $2,000 A YEAR HEATING WITH LO-BLAST POWER GAS BURNERS

Notre Dame College for Women, So. Euclid, Ohio

Bernard Muhle, building superintendent says "Five years ago we converted to Lo-BLAST Gas Burners to fire the boilers for our heating system. Since then we have saved at least $2000 a year on fuel costs alone. On cool mornings in fall and spring, this gas equipment gives us quick heat for short periods, without wasting fuel on long warm-ups."

The amazing efficiencies achieved by Lo-BLAST Burners are the result of exclusive design and construction features. These power type burners use a quiet, low-speed blower to provide perfectly controlled primary and secondary air—completely independent of natural draft. When the burner shuts off there is no rush of draft air to carry heat up the chimney and thus waste fuel. Combustion is completed in an incandescent fire box with radiant heat applied to both crown sheet and side walls.

"Inshot" design, with all components outside the fire box simplifies installation and reduces maintenance cost. Every unit is factory tested on gas and shipped assembled, fully equipped with fool-proof safeties.

Send for descriptive literature.

Lo-BLAST and Economite Power Gas Burners are available in capacities from 75,000 to 30,000,000 BTU input. They can be installed in any boiler or furnace.

MID-CONTINENT

METAL PRODUCTS COMPANY

2717 N. GREENVIEW AVENUE · CHICAGO 14, ILLINOIS

WE HEAR THAT

Continued

CRANE CO. has purchased substantially all the assets of the *DEMING CO.* Deming is now a division of Crane. Crane has also announced the opening of a new showroom in Chicago, located in the Builder's Building at LaSalle & Wacker Dr. A further announcement stated that Crane has expanded its international facilities to the Far East with acquisition of a 21 acre tract in St. Marys, Australia, an industrial area near Sidney, New South Wales. Construction will begin immediately on a factory to produce valves, pumps, and other equipment. The new subsidiary will be known as *CRANE AUSTRALIA.*

James L. Clough has been elected president of the *CLAY FLUE LINING INSTITUTE.* Mr. Clough is sales manager for the Evans Pipe Co.

ORR & SEMBOWER, INC. has released to its distributors a boiler and burner leasing plan. Sizes are available from 20 to 600 hp, and in a variety of automatic models fired by gas, oil, and combination gas-oil.

The *DANVILLE DIV.* of *BOHN ALUMINUM & BRASS CORP.* has been expanded with 10,000 sq ft of space for dockage and warehousing of raw materials.

The Conneaut, Ohio, manufacturing division of *STRONG, CARLISLE & HAMMOND CO.* has changed its name to *STRONG.* The reason for the change as expressed by a company official "is to more clearly designate certain proprietary product lines manufactured and sold by Strong."

BUENSOD-STACEY CORP. has licensed *SINKO KOGYO CO., LTD.,* of Osaka, Japan, to manufacture and distribute the firm's dual duct high velocity air mixing units and allied equipment in Japan.

MID-CONTINENT METAL PRODUCTS CO. has moved into larger quarters at 2717 N. Greenview Ave., Chicago, Ill.

FAIRBANKS, MORSE & CO. has moved certain of its executive functions from Chicago to new offices in Yonkers, N.Y. The Yonkers address is 100 Electra Lane, East Station, Yonkers, N.Y. Among the functions remaining in the Chicago office are those regarding marketing and customer service.

ARCHITECTS AND ENGINEERS ARE SPECIFYING

Ewing

Gas Operated Automatic

HOT WATER HEATERS

SPACE-SAVING VERTICAL TYPE!

DESIGNED AND ENGINEERED for the INDUSTRIAL-COMMERCIAL USER

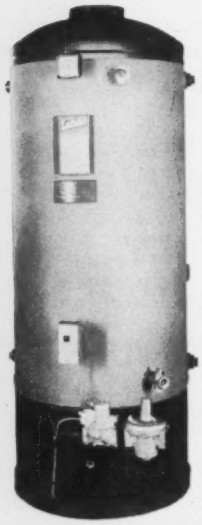
RECOVERY CAPACITIES

Gals. Per Hour 268.8 to 793.8 — Temp. Rise 100 Degrees F.

STORAGE CAPACITY

76 Gals to 217 Gals

4 New Models



HIGHEST QUALITY
1/4 INCH SHELL 3/8 INCH HEAD

AGA AND ASME APPROVED

BURNER ASSEMBLY COMPLETE AND FACTORY INSTALLED

Ewing heaters provide a constant, abundant supply of clear, clean low-cost hot water.

USE ANY TYPE GAS

Write, phone or wire for complete data sheets, specifications and prices.

Ewing MANUFACTURING CO.
2545 NW 10 P. O. BOX 873
OKLAHOMA CITY, OKLA.

MEETINGS & CONVENTIONS

OCT. 7-10 — *Western Building Industries Exposition.* Great Western Exhibit Center, Los Angeles, Calif. Information: Western Building Industries Exposition, 2216 S. Hill St., Los Angeles 7, Calif.

OCT. 9-11 — *Technical Committee on Cooling Water Problems, North Central Regional Meeting of the National Association of Corrosion Engineers.* Chase Park Plaza Hotel, St. Louis, Mo. Information: Otto H. Fenner, Monsanto Chemical Co., 1700 S. 2nd St., St. Louis 4, Mo.

OCT. 13-15 — *Refrigeration and Air Conditioning Contractors Association National Board of Directors Meeting.* Hotel Riviera, Las Vegas, Nev. Information: Joseph L. Koach, executive director, Refrigeration and Air Conditioning Contractors Association, 20 N. Wacker Dr., Suite 2265, Chicago 6, Ill.

OCT. 16-17 — *International Conference on Air Ionization.* Franklin Institute, Philadelphia, Pa. Information: American Institute of Medical Climatology, 1618 Allengrove St., Philadelphia 24, Pa.

OCT. 16-20 — *National Safety Council Annual Convention.* Industrial sessions will be held in various hotels, Chicago, Ill. Information: National Safety Council, 425 N. Michigan Ave., Chicago, Ill.

OCT. 19-20 — *Institute on Preparing Construction Contracts and Specifications.* University of Wisconsin, Madison, Wis. Information: Edward O. Busby, 3040 Stadium, The University of Wisconsin, Extension Div., Madison 6, Wis.

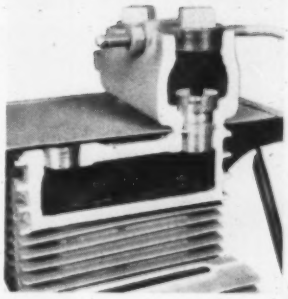
OCT. 23-26 — 1961 *Conference and Exhibition of the South Central Region of the National Association of Corrosion Engineers.* Shamrock Hilton Hotel, Houston, Tex. Information: National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Tex.

OCT. 25 — *Society for Nondestructive Testing Utilities Committee Fall* 1961 *Meeting.* Cobo Hall, Detroit, Mich. The conference is part of the annual fall meeting program held by the Society for Nondestructive Testing concurrently with meetings of the American Society for Metals, the American Institute of Mining and Metallurgical Engineers and Metal Show. Information: Helmut Thielsch, Grinnell Co., Inc., Providence 1, R.I.

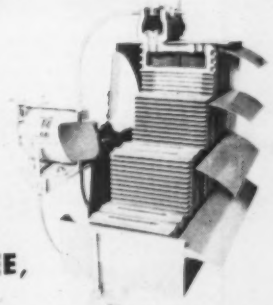
OCT. 29-31 — *Fall Meeting of the Fluid Controls Institute, Inc.* Hotel Hershey, Hershey, Pa. Information: Fluid Controls Institute, Inc., P.O. Box 667, Pompano Beach, Fla.

Only With

GRID*



UNIT HEATERS and BLAST HEATERS



***CAN YOU GET MAINTENANCE-FREE, TROUBLE-FREE *Life Long* HEATING SERVICE . . .**

It is possible because GRID is made to be maintenance-free, trouble-free . . . installations in 1929 are still operating without repairs. GRID construction and material - inside and out - account for GRID life long heating service.

GRID one piece cast iron steam chambers and headers eliminate internal corrosion . . . There's only one metal in contact with steam. No electrolysis is developed internally to eat away the heating elements. No leaks from rotted cores. And, GRID is leak-proof on steam pressures up to 250 P.S.I. 450° temperature. Specially designed units available for use on super heated steam.

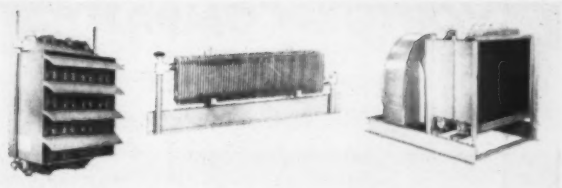
GRID cast iron construction resists corrosion externally from acid fumes or other destructive elements in the atmosphere . . . cannot destroy GRID cast iron fin heating surface. Widely spaced fins cast integral with the steam chamber will not corrode and are easy to clean . . . will not "mat" on air intake side.

For trouble-free heating in your plant, write for complete information on GRID . . . ask for GRID products catalog No. 956.

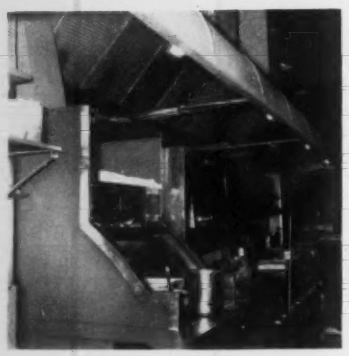
D. J. MURRAY MANUFACTURING CO

Manufacturers Since 1883 • WAUSAU, WISCONSIN

UNIT HEATERS RADIATORS BLAST HEATERS



VORTOX AIR FILTERS



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MEETINGS & CONVENTIONS

Continued

NOV. 1-3 — *Consulting Engineers Council Semi-Annual Meeting.* Golden Gate Hotel, Miami Beach, Fla. Information: Larry Spiller, executive secretary, 322 Reisch Building, Springfield, Ill.

NOV. 6-10 — *Meetings of The American Nuclear Society, The Atomic Industrial Forum, AtomFair, and National Youth Conference on the Atom.* Chicago, Ill. Information: John L. Kuranz, ANS general meeting chairman, vice president of Nuclear-Chicago Corp., 333 E. Howard Ave., Des Plaines, Ill.

NOV. 7-10 — *National Warm Air Heating and Air Conditioning Association Annual Convention.* La Salle Hotel, Chicago, Ill. Information: National Warm Air Heating and Air Conditioning Association, 640 Engineers Bldg., Cleveland 14, Ohio.

NOV. 12-15 — *Air-Conditioning and Refrigeration Institute Annual Meeting.* The Homestead, Hot Springs, Va. Information. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

NOV. 13-17 — *American Public Health Association, 89th Annual Meeting, Air Pollution Session,* Cobo Hall, Detroit, Mich. Information: American Public Health Association, 1790 Broadway, New York 19, N.Y.

NOV. 26-*DEC.* 1 — *The American Society of Mechanical Engineers Winter Annual Meeting.* Statler Hilton Hotel, New York, N.Y. Information: L. S. Dennegar, director of public relations, American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N.Y.

NOV. 28-30 — *Building Research Institute's* 1961 *Fall Conference.* Mayflower Hotel, Washington, D.C. Information: Milton C. Coon, Jr., executive director, Building Research Institute, 2101 Constitution Ave., Washington 25, D.C.

1962

JAN. 22-25 — *Plant Engineering and Maintenance Conference and Show.* Convention Hall, Philadelphia, Pa. Information: Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

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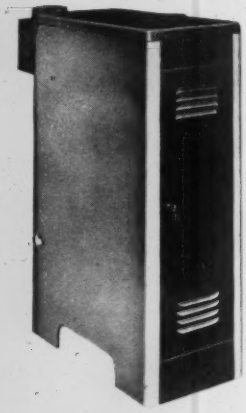

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TITLE
COMPANY
ADDRESS

MEETINGS & CONVENTIONS

Continued

JAN. 28-31 — *American Society of Heating, Refrigerating and Air-Conditioning Engineers Semi-Annual Meeting.* Chase-Park Plaza Hotel, St. Louis, Mo. Information: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 345 E. 47th St., New York 17, N.Y.

FEB. 12-15 — *Air Conditioning and Refrigeration Industry 12th Exposition.* Great Western Exhibit Center, Los Angeles, Calif. Information: George E. Mills, Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C.

MARCH 19-21 — *Second National Electric Comfort Heating Exposition, National Electrical Manufacturers Association.* Sherman Hotel, Chicago, Ill. Information: National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N.Y.

MARCH 19-23 — *National Association of Corrosion Engineers Annual Conference and 1962 Corrosion Show.* Kansas City Auditorium and Muehlebach Hotel, Kansas City, Mo. Information: National Association of Corrosion Engineers, 1061 M & M Building, Houston 2, Tex.

APRIL 25-29 — *Western Space Age Industries and Engineering Exposition.* Cow Palace, San Francisco, Calif. Information: Lykke-Wilkin & Associates, 681 Market St., San Francisco 5, Calif.

MAY 8-11 — *Mechanical Contractors Association of America 73rd Annual Meeting.* Sheraton Hotel, Philadelphia, Pa. Information: Mechanical Contractors Association of America, Inc., 45 Rockefeller Plaza, New York 20, N.Y.

JUNE 4-7 — *Annual Meeting of the Institute of Boiler and Radiator Manufacturers.* Seaview Country Club, Absecon, N.J. Information: Institute of Boiler and Radiator Manufacturers, Room 408, 608 Fifth Ave., New York 20, N.Y.

JUNE 18-20 — *Annual Meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.* Deauville Hotel, Miami Beach, Fla. Information: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 345 E. 47th St., New York 17, N.Y.

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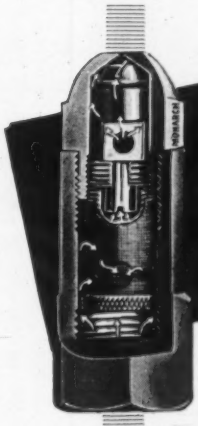

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NEW BOOKS & REPORTS...

Ventilation of Restaurant Cooking Equipment, NFPA No. 96 — A suggested method for cleaning restaurant grease ducts has been added to the NFPA standard for the ventilation of restaurant cooking equipment. This and the specific requirement that hoods be made of steel, stainless steel, or copper constitute the most significant changes incorporated into the eight page 1961 revision of the standard adopted recently. Three other pamphlets are available: *Terms Relating to Chimneys, Gas Vents and Heat Producing Appliances*, NFPA No. 97M; *Chimneys, Flues, and Vents*, NFPA No. 211 (In both of these, a definition of the new Type-L venting system is added); and *Guide for Smoke and Heat Venting*, NFPA No. 204, the work of the NFPA Committee on Building Construction. Prices, NFPA Nos. 96, 97M, and 211, 40 cents each; No. 204, 50 cents. — *National Fire Protection Association, 60 Batterymarch St., Boston* 10, *Mass.*

Dehumidifiers, DH 1-1961 — Establishes a uniform procedure for determining the performance of self-contained electrically-operated mechanically-refrigerated dehumidifiers. Covers definitions, ratings, tests, and safety. Price, 25 cents (minimum order, $1.00). — *National Electrical Manufacturers Association*, 155 *E. 44th St., New York* 17, *N.Y.*

Principles of Air Conditioning — A text-book on air conditioning designed primarily for use in vocational schools and technical colleges, written by Paul Lang, technical editor in the application engineering department of Carrier Air Conditioning Co. Describes in simple terms the hows and whys of technical air conditioning problems encountered by technicians and servicemen. Included in the 327 pages are more than 500 illustrations and tables related to air conditioning equipment. — *Delmar Publishers, Inc., Mountain Ave., (Coloine) Albany, N.Y.*

Standard Classification for Copper and Copper Alloys (Wrought Products Only) — The system of classification assigns three-digit numbers, beginning with Copper No. 101, to more than 100 commercially important wrought copper and copper alloys. Unassigned numbers have been left in each general alloy category so that other coppers and/or alloys may be added later on as they prove to be of sufficient interest to users. Approximately one third of the numbered alloys in the new system are considered "standard" by the industry. — *Copper & Brass Research Association, 420 Lexington Ave., New York* 17, *N.Y.*

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Simply depress lever and tongs grip metal at pre-determined pressure, switch is turned on and weld sequence timer is actuated for precise period set on control dial. Thus, every weld is identical until timer adjustment is changed. Pilot light indicates when welder is connected.

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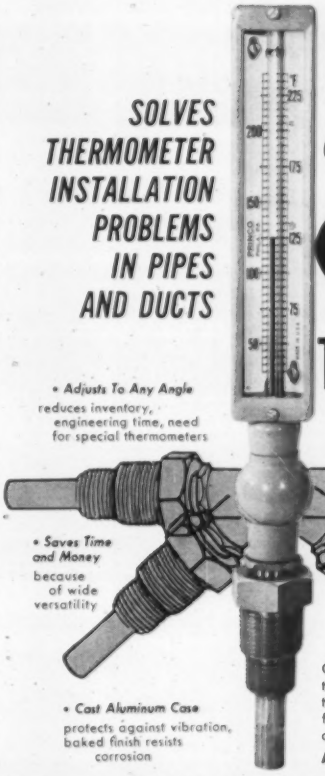

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THERE ARE DEFINITE STANDARDS which Air Engineers follow in recommending the filter for your requirements. Write today for details and information.

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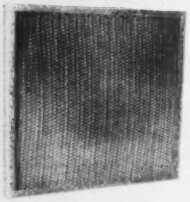

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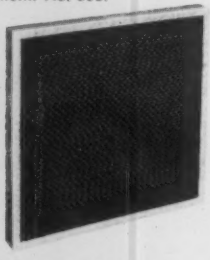

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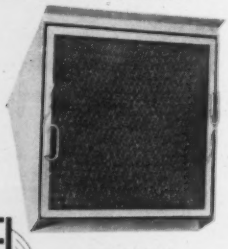

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How Dust Filter Selection Depends on Electrostatics — Written by E. R. Frederick, Senior Fellow, Mellon Institute, this eight page report discusses the electrostatic behavior of both dust and filter fabric. Presents various performance data in table form. Report will be sent free of charge upon request. — *Office of Public Relations, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.*

Trig, Log, Antilog, and Log of Trig Functions 6 Place Tables — All the tables listed in the above title are in this handy (2⅝ by 5⅝ in.) 192 page vest-pocket book. Also includes eight pages of formulas and eight pages of interpolation. Book is indexed. Price, $1.00. — *Ottenheimer Publishers, Inc., 4805 Nelson Ave., Baltimore 15, Md.*

American Council of Independent Laboratories, Inc., Directory, Eighth Edition — Lists over 574 services performed by its members. Index is divided into four geographical sections of the United States to speed selection of a suitable situated laboratory. The association has 79 members and 93 branches throughout the U. S., Canada, Central America, Puerto Rico, and Hawaii. Available without charge to industrial and government executives when requested on company or official letterhead. — *Executive Secretary of the ACIL, 4302 East-West Highway, Washington 14, D.C.*

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WANTED — Agents handling HVAC equipment and calling on architects, engineers, contractors, etc., to handle a complete line of registers, grilles and ceiling diffusers. Liberal commission basis and exclusive territories are available. Write lines carried, territory and types of accounts covered. Reply Key 1519A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

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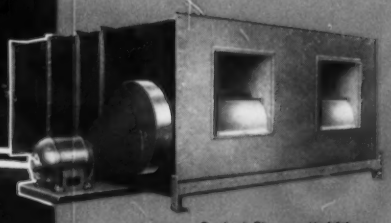

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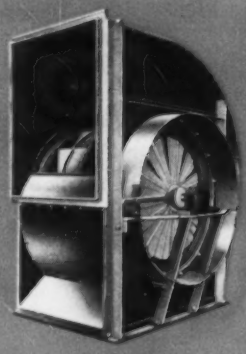

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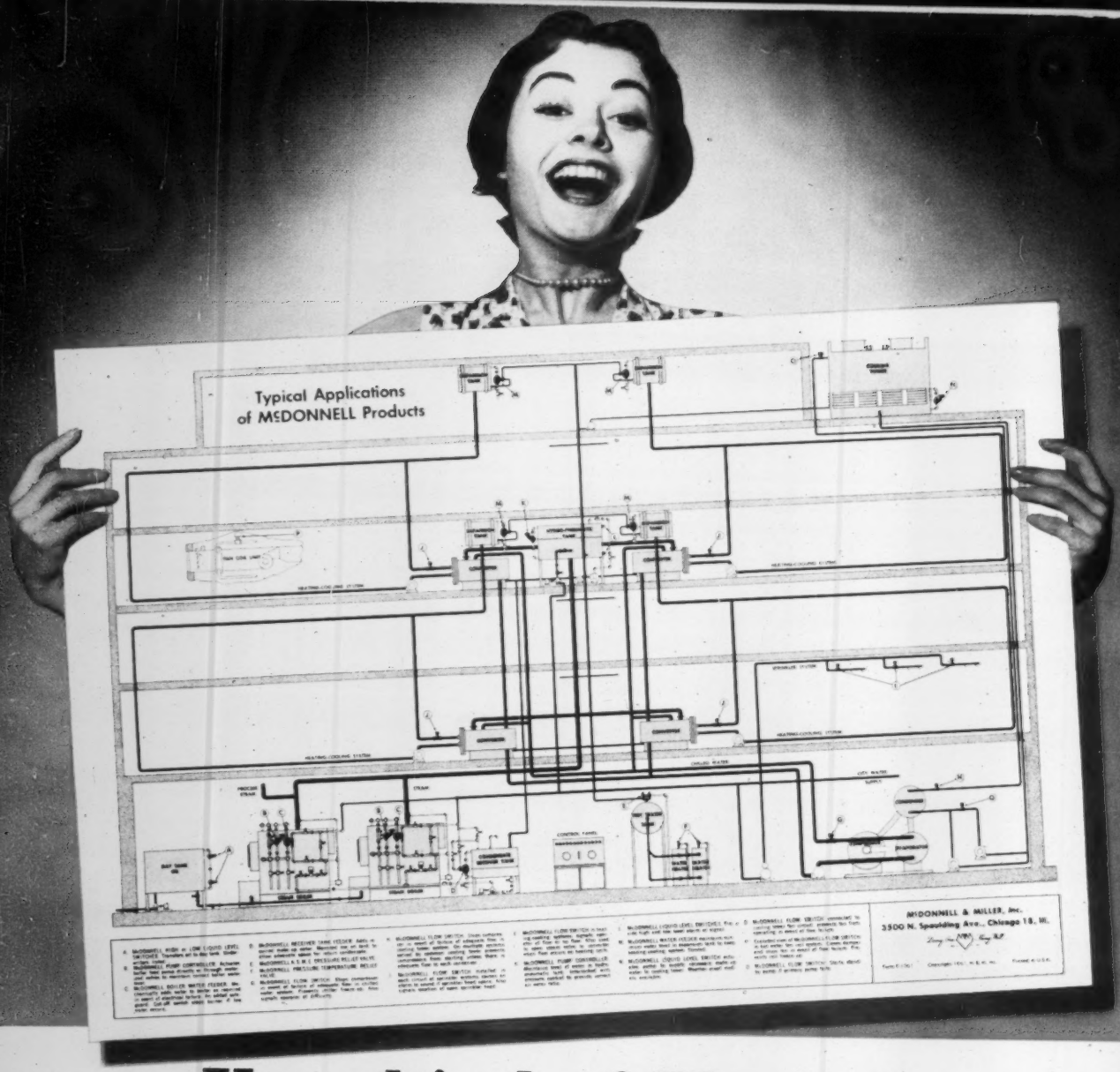

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